Wilson Ornithological Club
NOV 25 55

THE CONDOR

Volume 57 November-December, 1955 Number 6

JOURNAL OF THE COOPER ORNITHOLOGICAL SOCIETY

THE CONDOR

JOURNAL OF THE COOPER ORNITHOLOGICAL SOCIETY

Published bi-monthly at Berkeley, California. Entered as second-class matter at the post office at Berkeley, California, May 15, 1925, under Act of Congress of March 3, 1879. Issued from the office of THE CONDOR, Museum of Vertebrate Zoology, Berkeley 4, California.

MANUSCRIPTS

Send manuscripts for publication to the Editor, ALDEN H. MILLER, Museum of Vertebrate Zoology, Berkeley 4, California, or to the Associate Editor, FRANK A. PITELKA, same address. Refer to suggestions on preparation of manuscripts for THE CONDOR on the back cover of recent issues of the journal.

SUBSCRIPTION RATES

Subscription price to non-members, five dollars per volume, payable in advance. Single copies, one dollar each.

MEMBERSHIP DUES

Active members, four dollars per year in the United States, of which $3.00 is for a year's subscription to The Condor; four dollars and twenty-five cents per year in all other countries in the International Postal Union.

Sustaining members, five dollars per year.

The life membership fee is one hundred dollars. No additional dues are required. The money is invested and the interest only is used for Society publications. Life members receive THE CONDOR without additional charge. Concerning memberships, address C. V. DUFF, 1922 Tamarind Ave., Hollywood 28, California.

Send dues, subscriptions and notices of change of address to JACK C. VON BLOEKER, JR., Los Angeles City College, 855 N. Vermont Ave., Los Angeles 29, California.

Send orders for back numbers of THE CONDOR and the PACIFIC COAST AVIFAUNA series to THOMAS R. HOWELL, Department of Zoology, University of California, Los Angeles 24, California.

Issued November 18, 1955

CONTENTS

PAGE

Variation of the Common Rough-legged Hawk in North America ... *Tom J. Cade* 313

History of the Nesting of an Anna Hummingbird ... *Junea W. Kelly* 347

Age, Molt and Weight Characteristics of Blue Grouse ... *James F. Bendell* 354

Nocturnal Decline in the Temperature of Birds in Cold Weather ... *Laurence Irving* 362

North American Shore Birds in Surinam ... *F. Haverschmidt* 366

Great Crowned Pigeon, a photograph ... *Kenton C. Lint* 369

FROM FIELD AND STUDY

Cyanide Poisoning of Songbirds by Almonds ... *Wallace G. Macgregor* 370

The Rufescent Mourner in Chiapas, Mexico ... *Miguel Alvarez del Toro* 370

A Supposed Record of a Fossil Cormorant ... *Alexander Wetmore* 371

Hermit Warbler at Roswell, New Mexico ... *Vester Montgomery* 371

Notes on Food Habits of the White-tailed Kite in Southern California ... *John D. Cunningham* 371

Killdeer Fails to Desert Displaced Nest ... *Chapman Grant* 372

Distributional Records of Waterfowl from the Interior of Alaska ... *Brina Kessel* 372

Brown Creeper, a photograph ... *Ken Legg* 373

Acorn Woodpecker on Santa Catalina Island, California ... *Alden H. Miller* 373

NOTES AND NEWS ... 374

COOPER SOCIETY MEETINGS ... 374

INDEX TO VOLUME 57 ... *Sylvia L. Thomssen* 376

THE CONDOR

VOLUME 57 NOVEMBER-DECEMBER, 1955 NUMBER 6

VARIATION OF THE COMMON ROUGH-LEGGED HAWK IN NORTH AMERICA

By TOM J. CADE

INTRODUCTION

The Common Rough-legged Hawk (*Buteo lagopus* Pontoppidan) is a polytypic species of panboreal distribution. During the breeding season it is restricted to the circumpolar tundra biome and to the tundra-forest ecotone, except on Kamchatka where, according to Dementiev *et al.* (1951:307), it also breeds in the true boreal forest.

Three or four subspecies are currently recognized. *Buteo lagopus lagopus* breeds from Scandinavia east nearly to the Yenisei River in the Soviet arctic. The Siberian form, which has usually been called *pallidus* Menzbier, breeds from the Yenisei eastward to the Anadyr Peninsula and to the shores of Bering Strait. A third described race in the Old World, *kamtschatkensis* Dementiev, is said to breed on the peninsula of Kamchatka, on Bering Island, on the western shore of the Sea of Okhotsk, and on the Kurile Islands (Dementiev *et al.*, 1951:314). Finally, there is *sanctijohannis* Gmelin [for orthography, see Article 15, Intern. Rules Zool. Nomen.], the breeding form of the American Arctic and Subarctic.

These subspecies have been poorly characterized in the literature because they are not defined by sharp differences. The American form is supposed to differ from *B. l. lagopus* by its smaller average size, by its polymorphism, and by the more variegated colors of the dorsal plumage. *B. l. lagopus* is said to be characterized by a more uniformly brown dorsal coloration, by a light-colored head relative to the back, and by the absence of a melanistic phase. The Siberian form is the most distinctive subspecies of the group. It differs from both *lagopus* and from *sanctijohannis* by its extremely pale coloration and, supposedly, by its larger average size. Finally, according to Dementiev (1931:54–55), who described *kamtschatkensis*, and Dementiev *et al.* (1951:315), who attempt to substantiate it, the Kamchatkan form differs from the Siberian form by its darker and more variegated colors (similar in this respect to *sanctijohhanis*) and by its still larger average size.

Some Russian authors, notably Stegmann (1937:216), consider *kamtschatkensis* only a variant of the Siberian form. He has shown that specimens from Kamchatka fall within the range of variability of the Siberian population and further that three of them that he examined are indistinguishable in color from the pale form. Also he pointed out that Dementiev's type specimen is a juvenile and that juveniles are poorly separable even in large series. In further support of Stegmann's contention, I can mention three specimens examined in the present study, a nesting pair from the lower Lena River and an adult male from Cape Bolshaja, which fit the description of *kamtschatkensis* but which were taken deep within the breeding range of the Siberian subspecies as given by Dementiev *et al.* (1951:312–313).

A number of writers have noted differences between the Rough-legged Hawks of northwestern Alaska and those from the region of Hudson Bay, Labrador, and New-

foundland. Nelson (1887:142) pointed out that many Alaskan specimens are quite light, particularly on the head, and on this basis he referred northwestern Alaskan birds to the typical race *lagopus*. He was incorrect, however, in stating that the "melanistic phase" does not occur in this region, as were Macoun and Macoun (1909:61). Friedmann (1934:246) later referred one of Nelson's specimens from St. Michael's, Alaska, to the Siberian form *pallidus* and discussed several intergrades from that area, suggesting that in the region of intergradation between *pallidus* and *sanctijohannis* the difference in size remains more constant than that of coloration. In 1938 (pp. 290-291), he discussed the birds of northwestern Alaska again, this time referring them to the form *kamtschatkensis,* which he considered to be distinct from *pallidus*. Bailey (1942: 305–306) reported an additional number of specimens from northwestern Alaska as *pallidus* and gave one definite breeding record from the Seward Peninsula; later (1948: 182) he mentioned one other breeding record based on a collected specimen. He was inclined to doubt, rightly as I hope to prove, that Asiatic and American birds could be distinguished on the basis of size, and he also stated with clear insight that "while many of the rough-legs of northwestern and Arctic Alaska are no doubt colored like Siberian birds, the converse would probably be true—that many from the Asiatic side would be called *s. johannis* if compared with birds of our own continent" (*loc. cit.*).

In the twentieth supplement to the A.O.U. Check-list (Wetmore *et al.*, 1945), *Buteo lagopus pallidus* (Menzbier) was recognized as an additional subspecies for North America; in the twenty-third supplement (Wetmore *et al.*, 1948), the name was changed to *Buteo lagopus kamtschatkensis* Dementiev, "because of the prior *Buteo pallidus* Lesson, Traite d'Orn., livr. 2, May, 1830, p. 82, for another species." Friedmann (1950:336) has apparently recently followed this decision because he has placed *pallidus* in the synonymy of *kamtschatkensis* and the breeding range given is that of the Siberian form, including Kamchatka and northwestern Alaska.

It is apparent that there are conflicts in the names currently applied to subspecies of *Buteo lagopus*. Dementiev *et al.* (1951:312) have also recognized the priority of *Buteo pallidus* Lesson, and while retaining *kamtschatkensis* as a distinct subspecies, they have renamed *Buteo lagopus pallidus* (Menzbier) as *Buteo lagopus menzbieri*. Whether *menzbieri* or *kamtschatkensis* succeeds *pallidus* as the name for the pale-colored Siberian form appears to rest on whether or not *kamtschatkensis* is a valid subspecies.

Field work.—During the summer of 1952, I was one of the several persons assigned to study the birds of the Colville River, northern Alaska, under contract between the Office of Naval Research and the University of Alaska—Contract Nonr-768(00), Project NR 307 019, Dr. Brina Kessel, principal investigator. One of the purposes of this investigation was to gather critical material for taxonomic work. Field observations and collecting were carried out from June 4 to August 19, 1952. During that time 48 nesting pairs of Rough-legged Hawks were studied, a series of 8 adults and 3 juveniles was collected, and a number of fledglings was banded, one of which was recovered the following November in southern Alberta. Particular attention was paid to plumages and molt in the living birds, which could be observed in detail at their nests.

While in the field, I became aware of the great variability of size and plumage in this population. It was particularly striking to find extremely melanistic individuals mated with very pale ones, and thus I began to question the correctness of considering the northwestern Alaskan hawks a New World contingent of the Asiatic subspecies. The subsequent work with museum material was, therefore, an outgrowth of impressions received on the breeding grounds in Alaska.

Acknowledgements.—This study was carried out under the direction of Thomas R.

Howell of the Department of Zoology of the University of California, Los Angeles, to whom I am much indebted for help and advice throughout the course of the work. I would like to thank the following people for the loan of material under their care: Herbert Friedmann, United States National Museum (USNM); John T. Zimmer, American Museum of Natural History (AMNH); W. Earl Godfrey, Canadian National Museum (CNM); L. L. Snyder, Royal Ontario Museum of Zoology and Paleontology (ROMZ); Brina Kessel, University of Alaska (U of A); A. L. Rand, Chicago Natural History Museum (CNHM); H. K. Gloyd, Chicago Academy of Sciences (Chic. Acad. Sci.); J. C. Greenway, Jr., Museum of Comparative Zoology (MCZ); Robert W. Storer, University of Michigan Museum of Zoology (UMMZ); Alfred M. Bailey, Denver Museum of Natural History (DMNH); K. C. Parkes and W. E. Clyde Todd, Carnegie Museum (CM). Alden H. Miller very kindly provided me with study facilities at the Museum of Vertebrate Zoology (MVZ), and Robert T. Orr gave me access to the series of *Buteo lagopus* from Manchuria collected by A. S. Loukashkin and now deposited in the California Academy of Sciences (CAS). E. A. Simms of the British Museum (Natural History) was good enough to send me plumage descriptions of some specimens under his care. I am further indebted to L. L. Snyder for a discussion of sexual dimorphism in *Buteo lagopus*. Special acknowledgement is due my wife, Renetta Mae Cade, for invaluable assistance in the preparation of figures and tables.

MATERIAL AND METHODS

This study is based on an examination of 179 specimens, of which 73 were adult males, 65 adult females, and 41 juveniles. In so far as possible only material taken during the breeding season (May-August) has been used, the assumption being that such specimens were taken on, or reasonably near, their actual breeding grounds. Reilly (1954:162) has recently offered some justifiable objections to such an assumption, but for studies of variation requiring many specimens there seems to be no other recourse. The exception to this limitation is the sample from Asia, which consists of 10 summer- and 40 winter-taken individuals.

The geographic distribution of the specimens examined from North America is shown in figure 1. This distribution almost completely covers the known nearctic breeding range. Specimens were assigned to the following geographic groups for comparative study: (1) Asia; (2) Aleutian Islands and southwestern Alaska; (3) northwestern and northern Alaska; (4) western Canada; and (5) eastern Canada. The latter two groups were arbitrarily separated at 80 degrees west longitude. These groups can be considered more or less natural geographic units. The Bering Sea and the Arctic Ocean provide a hiatus in the breeding range between Asia and Alaska. In western Alaska just north of the base of the Alaska Peninsula there is the broad Yukon-Kuskokwim delta country, which because of its low, flat terrain is little suited to the nesting requirements of the Rough-legged Hawk and which, therefore, in terms of relative numbers acts as another hiatus between the abundant breeding populations of southwestern and northwestern Alaska. A similar situation is believed to exist in the region of the Mackenzie River delta, which separates the northern Alaskan hawks from those breeding east of the Mackenzie. In the eastern Canadian arctic the range is again disrupted by Hudson Bay, the east-west continuity of the population being maintained by only a few, scattered pairs nesting on islands.

Three measurements were taken: chord of the wing, diagonal of the tarsus, and chord of the entire culmen. The instructions of Baldwin, Oberholser, and Worley (1931:13, 76, 107) were followed. Measurements were read to the nearest millimeter only.

Fig. 1. Geographic distribution of specimens of *Buteo lagopus* from North America. Records include both adults and juveniles taken in the breeding season. Note peripheral nature of distribution.

The plumage traits employed in this study are those already used in descriptions of this species (see Friedmann, 1950; Witherby *et al.*, 1939). In addition, some other characters that proved to be important after an initial series had been examined were used. About a dozen plumage characters have been studied; these are described in table 4.

The original sex determination of all specimens has been accepted, although in a number of cases one may be practically certain that the specimen was incorrectly sexed. This increases the inaccuracy of the frequency distribution of the characters and tends to overemphasize the degree of overlap in traits between the sexes, but it has been done to avoid the criticism of biasing the data in favor of a particular result. On the other hand, in several instances where specimens that were recorded as adults were obviously birds of the year, a situation particularly easy to detect in males, I have felt justified in changing their status in the presentation of the data. Unsexed specimens, constituting less than 5 per cent of the total sample, were placed according to their appearance.

Formulae for all statistical calculations were taken from Simpson and Roe (1939), except as indicated in the footnote of table 3. Chi-square values were calculated directly from the raw data.

MOLT AND AGE CHARACTERS

Rough-legged Hawks undergo a single annual molt, which takes place mainly during the breeding season. Hence, specimens from the breeding range have only partly acquired fresh plumage, and this is the major disadvantage in studying a sample of breeding birds of this species. There is no postpuvenal molt, birds of the year retaining the feathers they acquire in the nest until the following spring, when they begin molting into a plumage that is essentially adult in character.

Bent (1937:273) has suggested that there is a second-year plumage somewhat intermediate between the juvenal and adult plumages, but I think his statements regarding the distinctions of these three are confusing and they are at variance with my own findings. After having examined a large series, however, I am left with the impression that there may be some progressive changes of the plumage with age. The older males in particular appear to become less pigmented, with fewer and smaller breast markings and

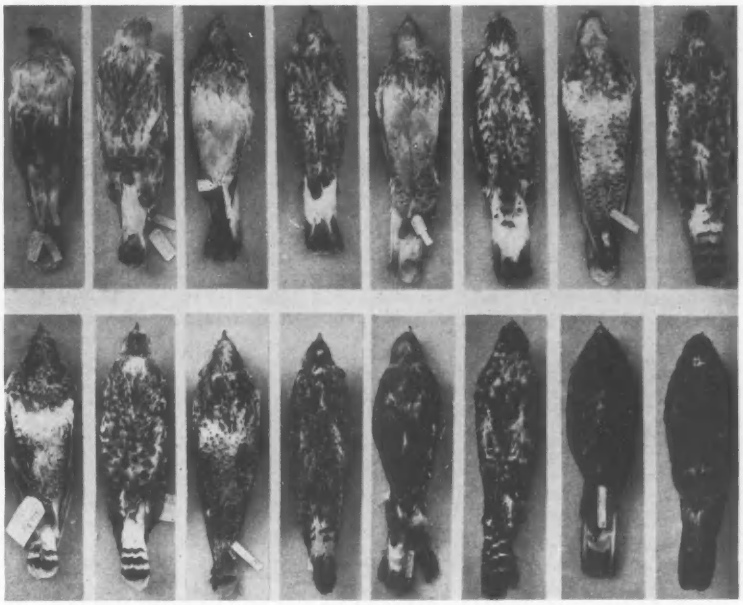

Fig. 2. Ventral and dorsal aspects of adult male Rough-legged Hawks. Upper row, from left to right: MCZ 92669, Altai Mountains; DMNH 22866, Wainwright, Alaska; U of A 614, Colville River, Alaska; AMNH 442641, Melville Peninsula, Canada. Lower row: CNHM *102133*, *Manchuria*; *CNM 16152*, *Labrador*; *USNM 299396*, *Izembek Bay*, *Alaska*; DMNH *25277*, *Meade River*, *Alaska*.

gradual reduction of the belly wash, until in some individuals (fig. 2) the ventral surface is almost immaculate. But certainly the major change in plumage occurs with the first molt.

According to Bent (*loc. cit.*), the annual molt occurs between April and November. From my sample it appears that most of the adults complete the greater part of their molt, especially that of the flight feathers, in June, July, August, and September. There is also an indication that the first annual molt begins earlier in the year than do subsequent ones; but few birds of the year survive to the time of molt, and hence there are few immature specimens for comparison.

In so far as possible detailed records were kept on the molting of Rough-legged Hawks observed along the Colville River in 1952. With practice it was possible to determine with considerable accuracy the condition of the remiges and rectrices of birds as they soared about their nests. Notes were also taken on the molt of freshly collected specimens. The primaries of this species are normally molted from the fourth outward, the innermost three molting in sequence with the secondaries; and the rectrices are molted from the central pair outward. It is therefore possible to determine the stage of molt of a particular individual by noting which feathers are missing. Table 1 summarizes data secured on the Colville River. Birds observed after July 26, the last date indi-

Table 1

Summary of Observations on the Molt of *Buteo lagopus* along the Colville River, Alaska, in 1955

Date	Males	Females
June 17	1 with right 7th primary just coming in and many new dorsal feathers.	2 with right and left 7th primaries and one central rectrix molted.
June 18	1 with right and left 7th primaries just coming in.	1 with right 4th and 5th coming in and left 4th coming in, left 5th complete.
June 20	2 with no visible molt.	1 with left 7th molted. 1 with right and left 7th primaries molted.
June 22	2 with right 7th primary molted. 1 with right and left 7th primaries molted.	3 with right 6th and 7th and left 7th primaries molted. 1 with right and left 7th primaries molted. 1 with right and left 6th primaries and one central rectrix molted. 1 with right and left 3rd or 4th primaries molted; 5–7th ones growing in.
June 25	1 with left 6th half in and right 7th half in; right central rectrix just coming in.	1 with 3rd or 4th primaries molted.
June 27	3 with no visible molt. 2 with right and left 7th primaries coming in. 1 with left 7th primary molted. 1 with right and left 3rd and 4th primaries molted (sex doubtful). 1 with 6th and 7th primaries coming in.	2 with right and left 2nd or 3rd primaries molted. 1 with left 7th molted. 2 with right and left 7th primaries molted. 1 with right and left 6th primaries molted; 7th ones coming in . 1 with 6th and 7th primaries and one central rectrix coming in.
July 5	1 with right and left 2nd or 3rd primaries molted.	1 with molted secondaries.
July 6	1 with right and left 3rd or 4th primaries molted.	1 with right 5th primary half in.
July 7	1 with right and left 2nd or 3rd primaries molted.	1 with secondaries molted on both wings.
July 8	1 with right and left 2nd or 3rd primaries molted. 1 with right and left 3rd or 4th primaries molted.	1 with all fresh primaries. 1 with a few molted secondaries.
July 10	1 with right and left 5th primaries just coming in.	1 with right and left 3rd primaries just coming in; one molted secondary on left and both central rectrices coming in. 1 with all new remiges and central rectrices molted.
July 26	1 with no visible molt.	1 with no visible molt.

cated in the table, were so far progressed in the molt of flight feathers that determinations were no longer possible.

In addition to showing that the main molting activity occurred in June and July in that population that year, the data also indicate that the females molt ahead of the males. This was even more evident when the male and female of a given pair were compred. A similar sexual difference in timing was observed for Peregrine Falcons (*Falco peregrinus*) breeding in the same region, and Beebe (1953:11) has recently recorded the same thing for this species on the islands off the coast of British Columbia. This may therefore be a widespread phenomenon among falconiform species, and it could be cor-

related with the usual social arrangement among mated hawks in which the male does most of the hunting, and hence most of the flying, during the incubating and nestling period, while the female remains close to the nest. After the young have fledged she then assumes a more active role as food provider.

There is no sexual dimorphism of the first-year plumage, and individual and geographic variation is much less than among adults (see table 5). Friedmann (1950:327) gives a concise and accurate description of the immature plumage. I will therefore restrict my statements to a consideration of the several traits studied in detail by me as they occur in the first-year bird.

The tail pattern is nearly always type D (table 4), occasionally type C, especially in the Asiatic sample, and occasionally type E in the American sample only; it is never type A or B. The belly pattern is most frequently type E, occasionally type D, especially in the Aciatic sample, and occasionally type F in the American sample only; it is never type A, B, or C.

The marginal coverts of the juvenal wing are most frequently type I; occasionally, especially in the Asiatic sample, they are type III; less frequently they are type II; also infrequently, in the American sample only, they are type IV.

Juvenal heads are more frequently type A than B, and the primaries are frequently type I, II, or III. These traits occur more frequently in juveniles of both continents than in their respective adult populations.

The shaft marks of individual feathers on juvenal breasts are usually wide and medium brown in color; but between the Asiatic and American samples there is almost a complete differentiation in the color of the feather margins. One hundred per cent of the Asiatic sample has whitish or creamy margins, and over 90 per cent of the American sample has buffy or reddish ones. The same difference holds for the feathers of the back.

The adult plumage of *Buteo lagopus* is extremely variable, being exceeded in this respect by only one other North American congener, *Buteo jamaicensis*. Friedmann's (1950:325-327) description, while accurate in its terms, suffers from being a composite of a series rather than a delineation of the range of adult variability. Again I shall discuss only those characters that I have subjected to quantitative study.

The adult tail pattern ranges through all types (see table 4e), although it is most frequently type A, B, or C, and much less frequently type D than in the case of the juvenal tail. The adult belly pattern also ranges through all types (table 4f), but it is less frequently type E than is the juvenal belly.

The marginal coverts of the adult wing are usually type I or II; occasionally in the Asiatic sample only they are type III, and occasionally in the American sample only they are type IV. The adult head is less frequently type A than is the juvenal head, and the adult primaries are less frequently type I or II than are those of the juvenal.

Adult hawks range through all the ventral and dorsal types of tables 4c and d.

INDIVIDUAL VARIABILITY

The variability of any sexually segregated sample of *Buteo lagopus* is great. For the mensural characters this is best seen by examining the statistics of table 2. An idea of the variability in plumage can be gained by looking at figures 2 and 3. Specimens DMNH 25277 and DMNH 22866 of figure 2 represent the observed extremes of male plumage. The females appear to be less variable in plumage than are the males.

The basic patterns of plumage remain relatively constant from individual to individual. Most of the gross differences in plumage can be attributed to the variable

Table 2

Measurements of *Buteo lagopus*

Dimension	Population	Sex	Number of specimens	Range	Mean with standard error	Standard deviation
Wing	Asia	M	23	396–448	418±3.38	16.22
		F	21	401–456	435±3.02	14.03
	Aleutians, SW Alaska	M	12	396–445	418±3.22	11.16
		F	13	430–461	445±2.52	9.11
	NW Alaska	M	14	394–444	424±4.36	15.29
		F	13	403–454	435±3.76	13.6
	W Canada	M	12	395–426	411±2.96	10.25
		F	8	413–459	436±4.87	13.77
	E Canada	M	12	392–412	406±1.71	5.92
		F	14	416–450	436±2.59	9.59
	American juveniles	M	9	340–470	422±8.46	25.38
		F	4	360–440	405	.....
	Asiatic juveniles	M	7	410–446	427±5.67	15.03
		F	2	438–452	445	.....
Tarsus	Asia	M	23	58–72	66.0±0.70	3.36
		F	20	61–75	68.6±0.89	4.02
	Aleutians, SW Alaska	M	12	65–71	68.3±0.55	1.92
		F	12	68–78	74.9±0.80	2.78
	NW Alaska	M	14	64–73	69.8±0.60	2.26
		F	13	67–77	71.9±0.88	3.19
	W Canada	M	12	62–72	67.9±0.78	2.96
		F	7	65–75	67.4±1.32	3.51
	E Canada	M	12	65–71	68.0±0.47	1.63
		F	14	69–75	71.3±0.48	1.83
	American juveniles	M	8	62–74	67.8±1.52	4.55
		F	5	68–72	69.4±0.66	1.49
	Asiatic juveniles	M	7	66–71	69.9±0.80	2.10
		F	2	71–77	74.0	.....
Culmen	Asia	M	23	31–40	33.7±0.40	1.94
		F	21	32–38	35.6±0.37	1.69
	Aleutians, SW Alaska	M	12	33–38	34.8±0.36	1.25
		F	12	35–39	36.8±0.39	1.37
	NW Alaska	M	13	33–38	35.1±0.43	1.55
		F	12	35–39	36.9±0.38	1.19
	W Canada	M	10	34–37	35.1±0.27	0.84
		F	7	35–39	37.0±0.53	1.41
	E Canada	M	11	32–38	35.0±0.49	1.65
		F	14	34–39	36.8±0.39	1.46
	American juveniles	M	9	32–38	34.1±0.59	1.79
		F	5	33–38	35.0±0.85	1.89
	Asiatic juveniles	M	5	34–37	35.5±0.89	2.01
		F	2	37–38	37.5	.....

amounts of melanin pigments deposited in the feather tracts. Concealed patterns are evident in even the most melanistic individuals upon close examination.

The American form of *Buteo lagopus* is said to be dimorphic or polymorphic. Thus Friedmann (1950:325-327) gives separate descriptions for the "light phase" and for the "melanistic phase," and there are numerous other references in the literature to the two-phase condition of *sanctijohannis*. Figures 2 and 3 show a complete range of intermediate plumages between the lightest and darkest specimen. The "two phases" of the

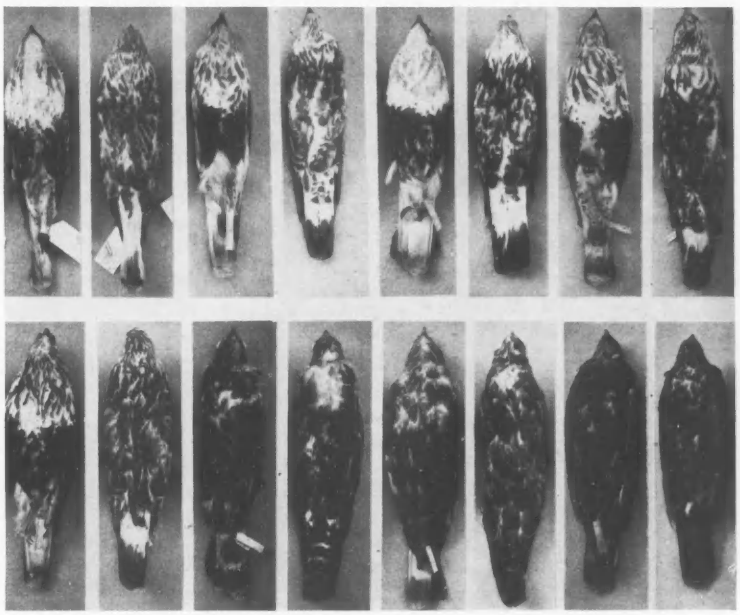

Fig. 3. Ventral and dorsal aspects of adult female Rough-legged Hawks. Upper row, from left to right: CNHM 101222, Manchuria; USNM 230742, Alaska Peninsula; DMNH 22867, Wainwright, Alaska; CNM 20984, Baffin Land, Canada. Lower row: DMNH 22868, Wainwright, Alaska; U of A 606, Colville River, Alaska; MCZ 234081, Amak Island, Aleutians; AMNH 269935, Port Moller, Alaska.

American Rough-legged Hawk are not discontinuous as is true of the Screech Owl (*Otus asio*) and some other species, and hence it is not polymorphic in the sense of Ford (1945), Huxley (1942:96), and others, especially Mayr (1942) and Mayr, Linsley and Usinger (1953:96). The condition can best be described as a wide range of continuous variation from a nearly uniform sooty plumage to a light brown one, the dark color being restricted ventrally to a few small marks on an otherwise white ground and dorsally by wide whitish edges on the individual feathers. Dark birds do not occur with the same frequency over the range of *sanctijohannis*, and in this respect they behave as a polymorph variant (see Mayr and Stresemann, 1950).

The variability within any population of *Buteo lagopus* is so great as to preclude accurate study of geographic variation without large series of skins. Even my samples, which are the largest yet compared, are inadequate for anything but approximations.

SEXUAL DIMORPHISM

Sexual dimorphism is clearly evident in many characters of *Buteo lagopus*, but as in every other aspect of variation, it is not marked by sharp discontinuities, that is, all males are not different from all females in any character studied, with one apparent exception to be mentioned later.

Size.—Following the rule among falconiforms, Rough-legged Hawks are sexually dimorphic in size, the female averaging larger than the male. There is, however, a great deal of overlap between the sexes in all mensural traits studied (table 2) except that of body weight. Table 3 compares the sexual dimorphism of these characters among the

Table 3

Comparison of Sexual Dimorphism in Mensural Characters among Sample Populations of *Buteo lagopus*

Population	Wing		Tarsus		Culmen	
	C.D.	P.J.N.	C.D.	P.J.N.	C.D.	P.J.N.
Asia	0.561	<75	0.189	<75	0.527	<75
Aleutian Islands and SW Alaska	1.33	<91	1.40	<92	0.769	>75
Northwest Alaska	0.384	<75	0.388	<75	0.666	<75
West Canada	1.04	85	0.08	<75	0.826	<80
East Canada	1.93	>96	1.06	>85	0.581	<75

C.D. stands for coefficient of difference; P.J.N. stands for per cent joint nonoverlap. See Mayr, Linsley, and Usinger, 1953:146, for explanation and interpretation of this statistic.

several geographic samples of this study. In 9 cases out of the 15 comparisons of table 3, the samples indicate only 75 per cent or less joint nonoverlap in size between the sexes. Some of the differences are not even statistically significant. There is, nevertheless, some apparent geographic variation in sexual dimorphism in size that will be dealt with later.

Because the data on body weight are meager, they are summarized here. The average weight in grams of 4 arctic Alaskan males collected on the Colville River in 1952 is 915 (883–943), and the average of 4 females from the same region is 1216 (1033–1400). Two specimens collected by O. J. Murie on the Old Crow River, Yukon Territory, have the following converted metric weights: female, 1176 gm.; male, 840 gm. Dementiev *et al.* (1951:312) give the average of 5 males of typical *lagopus* as 846 (800–930), and the average of 5 females as 1151.4 (990–1280). They also give (p. 315) the weight of one male *kamtschatkensis* as 900 gm., and of 2 females as 1050 and 1209 gm. Thus, in a total of 11 male weights and 12 female weights there is no *observed* overlap between the sexes, the largest male (943 gm.) and the smallest female (990 gm.), however, being separated by only 47 gm.

In view of the pronounced overlap in linear characters between the sexes, it is surprising not to find a corresponding amount of overlap in their weights. This circumstance suggests that none of the linear characters used in this study are accurate indices of over-all size in *Buteo lagopus*.

Plumage.—An entirely unsuspected finding of this study is the fact that the sexes of *Buteo lagopus* are partly dimorphic in plumage. I have found no mention of this in the literature, all authorities stating emphatically that the sexes are alike in this respect. Plate 65 (upper left fig.) of the "British Handbook" (Witherby *et al.*, 1939:33), painted by the late G. E. Lodge, correctly depicts some of the differences between the adult male and female, as well as differences between them and the juvenile, but no mention is made in the text of differences between the sexes.

Among the adult plumage traits previously mentioned, the following are in varying degrees sexually dimorphic: (1) tail pattern, (2) belly pattern, (3) marginal coverts

Table 4

Arbitrary Classifications of Plumage Characters

Character	Designation	Description
(a) Head types (crown and occiput)	A	Head distinctly lighter than rest of dorsal aspect; shaft streaks of feathers narrow.
	B	Head not distinctly lighter than rest of dorsal aspect; shaft streaks of feathers wide.
(b) Outer primaries (see fig. 5)	I	Outer 4 to 7 primaries with extensive (30–50 mm.) light area on outer webs distal to their coverts.
	II	Outer 3–5 primaries with moderate (10–20 mm.) light area on outer webs distal to the ends of their coverts.
	III	Outer 1–3 primaries with faint light area on outer webs.
	IV	All primaries lacking any light area on outer webs distal to the ends of their coverts.
(c) Breast	A	Light brown marks on feathers.
	B	Medium brown marks on feathers.
	C	Dark brown marks on feathers.
	D	Uniformly dark feathers.
	I	Shaft marks wide.
	II	Shaft marks narrow.
	a	Feather edgings whitish.
	b	Feather edgings reddish.
	ab	Feather edgings reddish and whitish.
(d) Dorsum	A	Light brown marks on feathers.
	B	Medium brown marks on feathers.
	C	Dark brown marks on feathers.
	D	Uniformly dark feathers.
	I	Shaft marks reduced; margins wide and intruding toward shaft.
	II	Shaft marks wide; margins narrow.
	a	Feather edgings whitish.
	b	Feather edgings reddish.
	ab	Feather edgings reddish and whitish.
(e) Tail	A	A dark subterminal band and 3 or more complete or incomplete ones proximal to it. Example, AMNH 442641 of fig. 2.
	B	A dark subterminal band and 1 or 2 complete or incomplete ones proximal to it. Example, CNHM 102133 of fig. 2.
	C	A distal "field" of brown with a faint darker subterminal band within it. Example, DMNH 23644 of fig. 6.
	D	A uniform distal field of brown; no subterminal band visible. Example, Chic. Acad. Sci. 4211 of fig. 6.
	E	Tail uniformly dark distal to the coverts (melanistic). Example, DMNH 25277 of fig. 2.
(f) Belly	A	Immaculate to very slight barring. Example, U of A 614 of fig. 2.
	B	Moderate barring. Example, AMNH 442641 of fig. 2.
	C	Heavy barring. Example, CNM 16152 of fig. 2.
	D	Lateral blotching. Example, CNM 20984 of fig. 3.
	E	Continuous band. Example, DMNH 22867 of fig. 3.
	F	Uniformly dark venter. Example, MCZ 234081 of fig. 3.
(g) Marginal coverts	I	Feathers with longitudinal shaft marks.
	II	Feathers with subterminal wedge-shaped marks.
	III	Feathers uniformly light (creamy) colored.
	IV	Feathers uniformly dark (reddish to sooty) colored.

of wing, (4) relative lightness of head to back, and (5) pattern of the dorsal feathers. The dimorphism is most pronounced in the first two categories.

One finds that in the tail classes A through D of table 4e (class E is excluded because of its low and nearly equal frequency in the two sexes), most males are in classes A and B, and most females are in C and D. There is overlap into nearly all classes by some specimens of both sexes (see table 5), but when the frequencies of the sexes are grouped into two categories, A–B and C–D, and tested by the chi-square method, the difference between all adult males and all adult females is significant beyond the 1 per cent level of confidence (table 6a). Figure 4 shows the "typical" male and female types of tail compared with the usual juvenal (non-dimorphic) type.

Similarly, in the belly classes of table 4f (F, the melanistic class, is excluded) most males are in classes A through C and most females in C through E. The C class is the

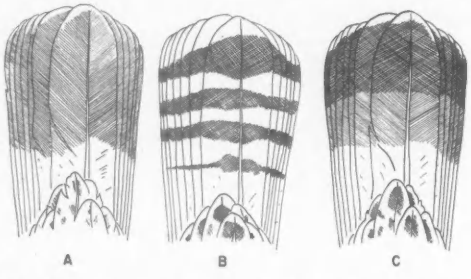

Fig. 4. Tail patterns of *Buteo lagopus*. A, juvenal (little variation); B, adult male (much variation; C, adult female (much variation).

principal area of overlap between the sexes, but this is at least partly a result of the arbitrariness of the classification and of the difficulty of deciding where to place borderline specimens between type B and C and between type C and D (see table 5). A significant difference beyond the 1 per cent level is again demonstrated (table 6h).

Among the classes of the marginal coverts of the wing, a large number of males occurs in class I and a large number of the females in class II. They are about equally distributed in classes III and IV. Testing male and female frequencies in the first two classes also yields a significant difference beyond the 1 per cent level (table 6aa and hh).

The ratio of type A to type B heads is greater in males than in females, and this difference proves to be highly significant (table 6s).

Finally, there are some subtle differences between males and females in the patterns and colors of the dorsum, but table 6gg reveals no statistical difference between the sexes for one dorsal character, and the classification of the others did not lend itself to statistical treatment. In general, it can be said that the male dorsum appears more variegated than the female, with much more white, brown, red, and often slate, showing in the individual feathers. The females appear more uniformly brown, with little white or reddish showing except on the margins, and seldom any slate. The individual feathers of males are frequently barred or blotched transversely in three or more rows with dark marks interspersed with reds, browns, and grays, whereas female feathers are seldom marked in this manner but usually show wide longitudinal shaft marks of brown, occasionally with indications of marginal blotching of the same color.

It is gratifying to have independent corroboration of these findings. L. L. Snyder, working with a much smaller series of Canadian specimens, but fortunately drawn from

an extremely homogeneous population, has found some of these same differences between the sexes.

A specimen that is masculine or feminine in one trait is usually masculine or feminine in the other sexually dimorphic traits also, but this is not always true. A few specimens combine typically male and female characters. Tail and belly patterns concord most completely and are the most reliable indicators of sex.

In a total of 137 adult specimens, only about 11 per cent are sexually heterogenous in tail and belly patterns. A closer discrimination of plumage types would probably have reduced this figure more. The differences between tail types B and C and between belly types C and D are quite arbitrarily defined.

About 9 per cent of the adult specimens have tail and belly types of the sex opposite to their recorded sex. I was at first tempted to explain this solely as the result of misidentification of sex on the part of earlier collectors. Since such a small percentage of the specimens is involved, this is not an unreasonable assumption. One of my own specimens, however, shows a sex reversal in plumage, so while incorrect sexing probably accounts for part of the 9 per cent, some biological factor must also be concerned.

GEOGRAPHIC VARIATION

Wing length.—The mean wing length of adult males ranges from 424 mm. in northwestern Alaska to 406 mm. in eastern Canada (table 2), and statistics derived from these two non-adjacent samples show about 80 per cent joint nonoverlap. Between any two adjacent samples, however, no joint nonoverlap approaches 75 per cent. There is an indication of a cline from short wings in eastern Canada to longer wings in northwestern Alaska and Asia, but the differences in the means of the several populations are scarcely significant statistically. There is certainly no difference among the northwestern Alaskan, Aleutian-southwestern Alaskan, and Asiatic populations.

The mean wing length of adult females ranges from 435 mm. in Asia and northwestern Alaska to 445 mm. in the Aleutians and southwestern Alaska. In this case the extreme populations are adjacent, but they show less than 75 per cent joint nonoverlap. The Aleutian-southwestern Alaskan females do, however, show a large divergence from the other samples, which are remarkably similar, differing by only one mm. in their means.

Diagonal of tarsus.—The mean tarsal length of adult males ranges from 66 mm. in Asia to 69.8 mm. in northwestern Alaska, and these two adjacent populations show nearly 75 per cent joint nonoverlap. Other adjacent populations of this series are statistically indistinguishable from each other, and no cline is indicated.

The mean tarsal length of adult females ranges from 68.6 mm. in Asia to 74.9 mm. in the Aleutians and southwestern Alaska, and these populations are separated by more than 82 per cent joint nonoverlap. Also the eastern Canadian and western Canadian populations show a joint nonoverlap of more than 75 per cent, and the northwestern Alaskan and western Canadian ones almost 75 per cent; but the pattern of variation is irregular. Northwestern Alaskan and Aleutian-southwestern Alaskan populations are not statistically different in this trait.

Length of culmen.—The mean culmen length of adult males ranges from 33.7 mm. in Asia to 35.1 mm. in northwestern Alaska and western Canada, but none of the differences is statistically significant, and no particular trend is indicated.

The mean culmen length of adult females ranges from 35.6 mm. in Asia to 37 mm. in western Canada, but this difference is not significant. The Asiatic sample shows the greatest deviation from the others in both males and females.

Table 5

Frequency Distribution of Plumage Characters among Sample Populations of *Buteo lagopus*

Population	Head		Web of primaries				Breast									Dorsum									Tail					Belly						Marginal coverts			
	A	B	I	II	III	IV	I	II	A	B	C	D	a	b	ab	I	II	A	B	C	D	a	b	ab	A	B	C	D	E	A	B	C	D	E	F	I	II	III	IV
Asia																																						
Males	8	15	9	4	4	6	17	6	9	13	1	0	23	0	0	16	7	10	9	4	0	17	0	6	2	16	4	1	0	4	9	2	5	3	0	5	8	8	0
Females	15	5	8	7	3	3	10	11	14	7	0	0	20	0	1	19	2	14	6	1	0	15	0	6	1	4	8	8	0	0	4	2	7	8	0	9	4	7	0
SW Alaska																																						
Males	1	12	0	0	1	12	10	0	0	4	6	3	6	3	1	3	8	0	5	6	2	0	2	10	2	5	3	1	1	0	1	4	2	3	2	2	10	0	1
Females	9	4	0	0	2	11	10	1	1	5	5	2	5	5	0	1	10	0	4	7	2	0	7	4	0	0	3	10	0	0	0	1	1	11	0	6	5	0	2
NW Alaska																																						
Males	2	12	0	1	2	12	12	2	2	10	2	1	14	0	0	7	7	2	10	2	1	0	0	14	2	8	1	3	1	4	4	3	2	1	1	2	10	0	1
Females	5	8	0	0	3	10	9	3	3	7	2	1	11	1	0	2	10	0	10	2	1	0	2	10	1	1	5	6	0	0	0	0	5	7	1	5	7	0	0
West Canada																																						
Males	1	11	0	0	0	12	12	0	0	8	4	0	11	0	1	6	6	0	6	6	0	1	0	11	7	5	0	0	0	3	5	4	0	0	0	0	11	0	1
Females	2	6	0	0	1	7	6	1	0	7	0	1	7	0	0	2	5	0	7	0	1	0	1	6	2	1	5	0	0	0	2	0	3	2	1	1	6	0	1
East Canada																																						
Males	0	12	0	0	0	12	11	0	0	3	8	1	9	0	2	1	10	0	2	9	1	0	0	11	8	3	1	0	0	1	4	6	0	0	1	0	11	0	1
Females	8	5	0	0	0	14	12	0	0	5	7	2	9	0	3	2	10	0	5	7	2	0	1	11	0	0	11	2	1	0	0	3	8	1	2	5	8	0	1
Asiatic juv.																																						
Males	7	0	5	0	2	0	5	2	1	6	0	0	7	0	0	3	4	3	4	0	0	4	0	3	0	0	2	4	0	0	0	0	4	3	0	6	0	1	0
Females	2	0	2	0	0	0	2	0	0	2	0	0	2	0	0	2	0	0	2	0	0	2	0	0	0	0	0	2	0	0	0	0	0	2	0	1	0	1	0
American juv.																																						
Males	6	5	1	1	3	5	8	4	1	6	4	2	1	11	0	7	6	0	7	5	2	0	12	0	0	0	2	12	0	0	0	0	2	11	1	7	1	2	1
Females	6	2	2	2	2	2	12	3	0	11	4	1	1	15	0	11	4	0	10	5	1	0	14	1	0	0	0	13	3	0	0	0	2	13	1	7	1	7	1

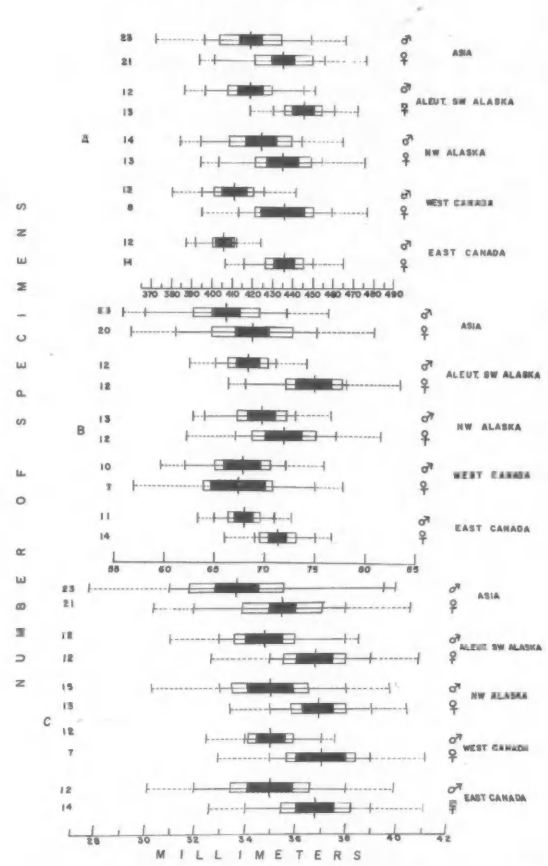

Fig. 5. Variation in measurements among sample populations of *Buteo lagopus* expressed as Dice squares. A, chord of wing; B, diagonal of tarsus; C, chord of entire culmen; see Hubbs and Perlmutter (1942) for discussion of use of Dice squares.

An important consideration emerges from a study of these measurements. Although any given population usually shows a wide range of variability, when geographic samples in a sexually segregated series are compared, the samples show remarkably little difference in their means. In other words, individual variability is great, but geographic variation is not. In every case standard errors of the means in the male series and in the female series overlap with one or more others. It appears impossible, therefore, to define geographic populations on the basis of measurements with the number of specimens now available by employing any accepted criterion of difference used to distinguish subspecies (Mayr, Linsley, and Usinger, 1953:143).

Although standard deviations are influenced by variables other than true biological ones, such as size of sample and non-random sampling, it is interesting to compare these

Table 6

Frequency Comparisons of Plumage Traits between Samples of Buteo lagopus

Comparisons	Breakdown of classes		Chi-square values	P values
TAIL	A–B	C–D		
(a) All adult males	58	10	57	<.01
All adult females	14	59		
(b)* Asiatic juveniles	2	6	5.4	<.02
American juveniles	2	25		
	C	D		
(c)* All adult females	33	26	16	<.01
All juveniles	4	31		
(d)* All adult Canadian females	16	2	10	<.01
All adult Alaskan females	8	16		
(e) All adult Alaskan females	8	16	1	>.1
All adult Asiatic females	9	8		
	A	E		
(f)* All adult Canadian males	15	8	5.44	<.02
All adult Alaskan males	4	13		
(g) All adult Alaskan males	4	13	1	>.1
All adult Asiatic males	3	20		
BELLY				
	A–C	D–E		
(h) All adult males	54	16	49	<.01
All adult females	12	53		
(i)* All adult Canadian males	23	0	5.6	<.02
All adult Alaskan males	16	8		
(j) All adult Alaskan males	16	8	1	>.1
All adult Asiatic males	15	8		
(k)* All adult Canadian females	5	14	2.8	<.1
All adult Alaskan females	1	24		
(l)* All adult Alaskan females	1	24	3.64	>.05
All adult Asiatic females	6	15		
	D	E		
(m) Asiatic juveniles	4	5	2.05	<.1
American juveniles	4	24		
(n) All adult females	24	29	5.24	<.02
All juveniles	8	29		
(o) All adult Canadian females	11	11	3.7	>.05
All adult Alaskan females	6	20		
(p) All adult Alaskan females	6	20	1	>.1
All adult Asiatic females	7	14		
	E	All others		
(q)* All adult Canadian females	3	19	12	<.01
All adult Alaskan females	18	8		
(r) All adult Alaskan females	18	8	4.5	<.05
All adult Asiatic females	8	13		
HEAD				
	A	B		
(s) All adult males	12	62	22	<.01
All adult females	39	28		
(t)* Asiatic juveniles	9	0	1.9	>.1
American juveniles	12	7		
(u) All adult females	39	28	2.3	<.1
All juveniles	....	....		
(v)* All Canadian males	1	23	1.0	>.1
All Alaskan males	3	24		
(w)* All Alaskan males	3	24	2.6	<.1
All Asiatic males	....	....		
(x) All Canadian females	10	11	1.0	>.1
All Alaskan females	14	12		
(y) All Alaskan females	14	12	2.1	<.1
All Asiatic females	15	5		
(z) All Canadian females	10	11	3.2	>.05
All Asiatic females	....	....		
MARGINAL PRIMARY COVERTS				
	I	All others		
(aa) All adult males	9	62	13	<.01
All adult females	26	41		
(bb) All juveniles	21	14	5.4	<.05
All adult females	30	37		
(cc) All juveniles	21	14	2	>.1
All adult males	50	21		
(dd)* All adult Canadian males	0	24	2	>.1
All adult Alaskan males	4	22		
(ee)* All adult Alaskan males	4	22	1	>.1
All adult Asiatic males	5	16		

	Comparisons	Breakdown of classes		Chi-square values	P values
(ff)	All Canadian females	6	16	2	>.1
	All Alaskan females	11	14	2	>.1
(gg)	All adult Alaskan females	11	14	1	>.1
	All adult Asiatic females	9	11		
		II	All others		
(hh)	All adult males	50	21	9	<.01
	All adult females	30	37		
(ii)*	All adult Canadian males	22	2	3	<.1
	All adult Alaskan males	20	6		
(jj)	All adult Alaskan males	20	6	7	<.01
	All adult Asiatic males	8	13		
(kk)	All Canadian females	14	8	2	>.1
	All Alaskan females	12	13	2	
(ll)*	All adult Alaskan females	12	13	2	>.1
	All adult Asiatic females	4	16		
		III	All others		
(mm)	*All adult American males	0	50	17	<.01
	All adult Asiatic males	8	13		
(nn)	All adult American females	0	47	14	<.01
	All adult Asiatic females	7	13		

	Comparisons	Breakdown of classes		Chi-square values	P values
		IV	All others		
(oo)*	All adult American males	4	46	1	>.1
	All adult Asiatic males	0	21		
(pp)*	All adult American females	4	43	1	>.1
	All adult Asiatic females	0	20		
	DORSAL EDGINGS				
		I	II		
(qq)	All adult males	33	38	1	>.1
	All adult females	24	39		
(rr)	All adult females	24	39	1	>.1
	All juveniles	22	14		
(ss)*	All east Canadian adults	3	20	2.3	<.1
	All west Canadian adults	8	11		
(tt)	All Alaskan adults	11	37	26	<.01
	All Asiatic adults	35	9		
	DORSAL COLORS				
		A–B	C–D		
(uu)	All east Canadian adults	7	19	29	<.01
	All west Canadian adults	13	7		
(vv)	All west Canadian adults	13	7	2	>.1
	All NW Alaskan adults	22	6		
(ww)	All NW Alaskan adults	22	6	18	<.01
	All Aleutian–SW Alaskan adults	9	17		
(xx)	All NW Alaskan adults	22	6	2	>.1
	All Asiatic adults	39	5		

* Yates' adjustment applied (see, for example, Simpson and Roe, 1939:296–300).

statistics in table 2. One is impressed particularly by the homogeneity of the eastern Canadian but also of the western Canadian (excluding the small female sample) and of the Aleutian-southwestern Alaskan populations as compared to the extremely variable Asiatic and northwestern Alaskan ones.

It should be pointed out that the Asiatic sample cannot strictly be compared with the other samples in this respect. It is not as seasonally homogeneous, being composed of both summer- and winter-taken specimens, and it was drawn from a much larger geographic area than were any of the four North American samples.

Still I feel that the relatively greater variability which is indicated for the populations of the Bering Sea region, excluding the Aleutians, is biologically real, especially since it is associated with a correspondingly great variability of the plumage characters in these populations.

Tail pattern.—In the adult male series, type A tails range from about 66 per cent in eastern Canada to less than 10 per cent in Asia. This trend is unbroken in the intermediate populations, with the sharpest change occurring between western Canada and northwestern Alaska. The type B tail ranges from 70 per cent in Asia to about 25 per cent in eastern Canada, showing a trend opposite to that of type A tails. Again the major disjunction occurs between western Canada and northwestern Alaska. The difference in frequency of types A and B between all Alaskan males and all Canadian males is statistically significant (table 6f), but it is not between Alaskan and Asiatic males (table 6g). It will be remembered that both these types of tail pattern are masculine characters. When they are grouped together, consistently high percentages result: 80 per cent in Asia; 72 per cent in northwestern Alaska; 60 per cent in the Aleutians and southwestern Alaska; 100 per cent in western Canada; 92 per cent in eastern Canada.

The low figure for the Aleutian-southwestern Alaskan males is partly the result of the greater number of melanistic individuals in that population, but the feminine types C and D still constitute 33 per cent, the highest figure for any male sample. The other figures are: 20 per cent in Asia, 28 per cent in northwestern Alaska, 0 per cent in western Canada, and 8 per cent in eastern Canada. Thus, tails of adult Canadian males differ in two respects from those of adult Alaskan males—they have a much higher percentage of extreme masculine types and a much lower percentage of feminine types (C and D). Alaskan males do not differ in these respects from Asiatic ones.

In the adult female series, the "juvenal" type D tail ranges from about 78 per cent in the Aleutians and southwestern Alaska to 0 per cent in western Canada, but no cline is indicated for this trait. The greatest difference in frequency occurs between western Canada and northwestern Alaska. The "typical female" type C tail ranges from 80 per cent in eastern Canada to about 23 per cent in the Aleutians and southwestern Alaska. The difference in frequency of these two types between all Canadian females and all Alaskan females is statistically significant (table 6d), but it is not between the Alaskan and Asiatic samples (table 6e).

It is relevant to mention here that the difference in frequency of types D and C between all adult females and all juveniles is also statistically significant at the 1 per cent level of confidence (table 6c), the juveniles having a higher frequency of type D. The difference between American and Asiatic juveniles is significant at the 2 per cent level of confidence (table 6b), Asiatic juveniles having a higher frequency of type C.

In adult females type A and B tails range from 37 per cent in western Canada to 0 per cent in the Aleutians and southwestern Alaska and in eastern Canada. They constitute 22 per cent of the Asiatic sample, and about 16 per cent of the northwestern Alaskan sample. The high percentage for western Canada is probably over-emphasized by the small sample and also by the arbitrariness of the classification, since there was a number of specimens in this sample that were intermediate between the masculine types and type C. None of the differences in frequency of these types is significant.

Belly pattern.—In the adult male series, the type A belly ranges from 0 per cent in the Aleutians and southwestern Alaska to about 28 per cent in northwestern Alaska. No cline is indicated. The type B belly ranges from about 41 per cent in western Canada to only 9 per cent in the Aleutians and southwestern Alaska; again there is no cline. The type C belly ranges from 50 per cent in eastern Canada to about 9 per cent in Asia, and in this case there is an unbroken east-west cline. The type D belly ranges from 0 per cent in both Canadian samples to about 22 per cent in Asia, and there is again an east-west trend. The type E belly ranges from 0 per cent in both Canadian samples to about 25 per cent in the Aleutians and southwestern Alaska and 22 per cent in Asia;

the same cline is indicated for this trait as for the type D belly. The type F belly ranges from 18 per cent in the Aleutians and southwestern Alaska to 0 per cent in Asia.

When types A through C are combined in one group, and types D and E in another, the difference in frequency between all Canadian males and all Alaskan males is statistically significant (table 6i), but the difference between Alaskan and Asiatic males (table 6j) is not. Thus, it can be said, first, that there are fewer extreme masculine bellies (types A and B) in the Aleutians and southwestern Alaska than in any of the other samples, but the difference between this sample and the northwestern Alaskan one is not statistically different. Second, there are fewer males with feminine bellies (types D and E) in the Canadian samples than in the Alaskan and Asiatic ones.

In the adult female series the type A belly does not occur. The type B belly ranges from 0 per cent in all but two samples to about 19 per cent in Asia and about 25 per cent in western Canada. The type C belly ranges from 0 per cent in northwestern Alaska and western Canada to about 21 per cent in eastern Canada. The type D belly ranges from about 8 per cent in the Aleutians and southwestern Alaska to 58 per cent in eastern Canada; and the type E belly ranges from about 8 per cent in eastern Canada to about 86 per cent in Asia. There is an inverse relationship between the last two types. The type F belly ranges from 0 per cent in Asia to about 18 per cent in the Aleutians and southwestern Alaska.

By grouping the types into two categories, A to C and D to E, a nearly statistically significant difference is again found between the frequencies of all Alaskan females and all Asiatic ones (table 6l), but not between all Canadian and all Alaskan females (table 6k). This indicates that Asiatic females have a greater tendency toward masculine bellies (types A, B, and C) than do females from the other regions. On the other hand, when the type E belly is compared with all other types together, one obtains a statistically significant difference (table 6g) between its frequency in Canadian and Alaskan females and between Alaskan and Asiatic females (table 6r). This results from a very high frequency of the type E belly in the Alaskan sample. The type D belly was similarly tested (tables 6o and 6p), but no significant differences were found between any of the adult female samples, although the difference between Alaskan and Canadian samples gives a chi-square value near that required for P to equal .05.

Marginal coverts of wing.—In the adult male series, type I covert ranges from about 23 per cent in Asia to 0 per cent in both Canadian populations. The Alaskan populations are intermediate with about 15 per cent each. Type II covert ranges from about 92 per cent in both Canadian samples to 39 per cent in the Asiatic, both Alaskan samples being again intermediate with about 78 per cent. Type I and II coverts are thus inversely related. Type III covert constitutes about 39 per cent of the Asiatic sample; it does not occur in any of the North American ones. Type IV covert constitutes about 8 per cent of the eastern Canadian, northwestern Alaskan, and Aleutian-southwestern Alaskan samples; it does not occur in the western Canadian or Asiatic ones.

The differences in frequency of type I between all Canadian and all Alaskan males and between all Alaskan males and all Asiatic males are not statistically significant (tables 5dd and 6ee), but there does seem to be a trend toward higher frequency of this type from east to west. The difference in frequency of type II between all Canadian and all Alaskan males likewise is not statistically significant (table 6ii), but the difference between all Alaskan males and all Asiatic ones is (table 6jj).

Thus, Asiatic males differ in three respects from North American males. They have a higher frequency of the feminine type I covert and a decidedly lower frequency of the masculine type II. In addition, they have a type III covert not found in the North

American samples (table 6mm). In turn, North American males have a type IV covert not found in the Asiatic sample (table 6oo).

In the adult female series, type I covert ranges from about 45 per cent in the Asiatic and Aleutian-southwestern Alaskan samples to about 12 per cent in western Canada. As in the male series, the general trend is from low frequency in the eastern samples to higher frequencies in the western ones, but the differences between Canadian females and Alaskan females, and between Alaskan and Asiatic females, are not statistically significant (tables 6ff and 6gg). Type II covert ranges from about 74 per cent in western Canada to about 20 per cent in Asia, and again an inverse relationship is evident between types I and II; statistically significant differences, however, are not found between the samples (tables 6kk and 6ll). Type III covert is not found in any of the American female samples, but it comprises about 38 per cent of the Asiatic one; this difference is statistically significant (table 6nn). Type IV covert is found only in the North American samples, but the difference between all North American females and all Asiatic ones is not statistically significant (table 6pp) because of its low frequency in the American samples and the disproportionately small Asiatic sample.

Asiatic females appear to differ from American ones in exactly the same respects that the males differ in this character.

Head.—In the adult male series, type A head ranges from about 37 per cent in Asia to 0 per cent in eastern Canada, indicating a cline toward greater frequency from east to west; but none of the American samples contains more than 15 per cent, the greatest disjunction being between the continental samples. Since only two types are involved for this character, the type B frequencies are in every case inverse to the type A frequencies. There are no statistically significant differences between Canadian, Alaskan, and Asiatic samples (tables 6v and 6w), but when all North American males are compared with all Asiatic ones, the difference is significant at the 1 per cent level of confidence.

In the adult female series, the type A head ranges from about 75 per cent in Asia to about 27 per cent in western Canada. The trend is unbroken to this point, but it is disrupted by the eastern Canadian females, which have about 61 per cent type A. No statistically significant differences are found between any of the samples (tables 6x, y and z).

Thus, there appears to be a trend toward higher frequency of type A heads in both males and females from east to west, but the samples are not large enough to give great confidence to this conclusion.

Outer web of primaries.—In the Asiatic sample about 74 per cent of the adult males and about 86 per cent of the adult females fall in classes I, II, and III. In the Aleutian-southwestern Alaskan sample none of the specimens falls in classes I and II, and only about 8 per cent of the males and 15 per cent of the females are in class III; all others are class IV. About 7 per cent of the northwestern Alaskan males are in class II, and about 14 per cent of the males and 23 per cent of the females are in class III; all others are class IV. In the Canadian samples only one specimen from western Canada is in class III; all others are class IV. The variation of this character expresses the clearest east-west cline to be found among the several traits studied. The greatest difference between adjacent samples occurs between Asia and Alaska, but it is important to know that the northwestern Alaskan sample contains the largest number of examples that are like the majority of Asiatic specimens—that is, with some degree of light coloring on the outer webs of the primaries distal to the ends of the coverts. Important also is the fact that no North American specimen approaches the extreme Asiatic expression of this character.

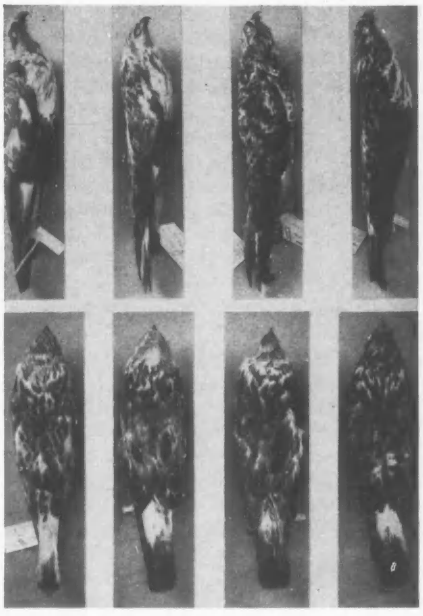

Fig. 6. Upper row, female specimens from left to right, showing, respectively, primary types I, II, III, and IV: USNM 370449, Manchuria; CNHM 101222, Manchuria; CNHM 101225, Manchuria; DMNH 22856, northwestern Alaska. Lower row, females: CNHM 101223, Manchuria; DMNH 19522, northwestern Alaska; Chic. Acad. Sci. 4211, northern Alaska; DMNH 23644, northwestern Alaska; note dark feathers on backs of two central specimens, contrasting sharply against an extremely worn and foxed plumage; these have been called *pallidus* by some authorities.

This character affords the best single criterion for separating adult Asiatic Rough-legged Hawks from American ones. On this basis alone about 80 per cent of all Asiatic adults are different from about 90 per cent of all American adults, and 80 per cent of all Asiatic adults are different from about 83 per cent of all Alaskan ones.

The trait of light areas on the outer primaries has a higher frequency among juveniles of both continents than among adults. It occurs on all Asiatic juveniles that have been examined (total of 9) and on 62 per cent of the American ones, but this difference cannot be considered significant because of the small Asiatic sample. There is a color difference that is perhaps more important. On all Asiatic juveniles the color of the light area is whitish or creamy, indistinguishable from the adult color. On nearly all North American specimens the area is buffy or reddish. Also, all the Asiatic juveniles have the extreme type I expression of this character; none of the American juveniles do.

Breast.—Frequencies of the several traits of the breast are presented in table 5. There is a trend toward higher frequency of the type II breast mark from east to west, and the greatest difference between adjacent samples occurs in the Bering Sea region, where over 50 per cent of the Asiatic females and 25 per cent of the males are type II, whereas only about 22 per cent of the northwestern Alaskan females and about 12 per cent of the males are type II. Again the northwestern Alaskan sample has the highest

frequency of this type among North American birds. Among the color classes there is also a tendency for light browns to increase in frequency in a westerly direction. The largest difference between adjacent samples is again in the Bering Sea region. There appear to be no pronounced differences among the samples in the edging classes *a*, *b*, and *ab*; there is a slightly, but not significantly higher frequency of the *a* type in the Asiatic sample, but the *b* and *ab* types are low in frequency in all the samples.

Back.—Frequencies of the various dorsal traits are also presented in table 5. In general these traits show the same trends as the ventral ones. Type II shows increase in frequency from east to west, and the lighter browns follow the same trend. The type *a* margin is much more frequent in the Asiatic sample, and the type *b* does not occur. The condition is reversed in the American samples. The difference in frequency of types I and II between all Alaskan adults and all Asiatic ones is statistically significant (table 6tt), but it is not between any of the other samples (tables 6gg, rr, and ss). When the dorsal color types are placed in two groups, A–B and C–D, and their frequencies compared among the samples, a statistically significant difference is found between all northwestern Alaskan adults and all Aleutian-southwestern Alaskan ones and between all eastern and western Canadian adults, but not between western Canadian and northwestern Alaskan adults or between northwestern Alaskan and Asiatic ones (tables 6uu, vv, ww, xx). In the latter comparison, however, there are important differences not brought out by this test: the D type does not occur at all in the Asiatic sample, and the A type does not occur in the northwestern Alaskan sample. When the frequency of the A type to all others is compared in the two samples, the difference is significant at the 1 per cent level of confidence.

SEXUAL DIMORPHISM

Size.—Turning again to table 3, it appears that there are some geographic differences in degree of sexual dimorphism. The Asiatic males and females show less than 75 per cent joint nonoverlap for all three measurements. The same is true of the northwestern Alaskan males and females, although their coefficients of difference average higher than in the Asiatic sample. In the Aleutian-southwestern Alaskan population the sexes show more than 75 per cent joint nonoverlap for each measurement, and indeed the two most reliable measurements, those of wing and tarsus, show more than 90 per cent joint nonoverlap. This population has the most consistent sexual divergence in size of any studied. The western Canadian sexes diverge to the extent of 85 and 80 per cent joint nonoverlap for two measurements but less than 75 per cent for the other. Also, the eastern Canadian sexes diverge to the extent of 96 per cent joint nonoverlap for the wing (the greatest for any measurement) and 85 per cent for the tarsus. The culmen shows less than 75 per cent. The small joint nonoverlap between the sexes in Asia and northwestern Alaska is at least in part the result of the greater variability of these populations, but the means of the males and females are actually closer in nearly every case.

Plumage.—For tail pattern there is a tendency among the samples for sexual dimorphism to break down in an east-to-west direction. This results from the fact that in the more westerly samples (Alaskan and Asiatic) both males and females have higher frequencies of characters that are in the overall population more characteristic of the opposite sex. Thus, in the Canadian samples more than 95 per cent of the adult males are separable from 100 per cent of the adult females; in the Alaskan samples slightly more than 62 per cent of the adult males are separable from slightly more than 92 per cent of the females; while in the Asiatic sample about 78 per cent of the males are separ-

able from about 74 per cent of the females. Expressing these relationships as percentages may overemphasize the actual difference between the populations, but the trend is the important thing.

A different relationship holds for belly pattern. Again the eastern Canadian sample shows the greatest sexual divergence and the greatest homogeneity of character in the two sexes; this condition breaks down in a westerly direction but not so completely as in the case of tail pattern. The male trend behaves exactly as it does for tail pattern, but the females show a slight but demonstrable reverse trend: that is, males have their highest frequency of masculine tails in the east and a progressively lower frequency westward, whereas females have their highest frequency of feminine tails in the west with progressively lower ones eastward. Thus, in eastern Canada about 95 per cent of the adult males are different from 63 per cent of the adult females; in Alaska about 59 per cent of the adult males are separable from more than 84 per cent of the females; and in Asia 65 per cent of the adult males are separable from more than 71 per cent of the adult females. The actual difference between the sexes is probably greater than these figures suggest because of the wide range of characters subsumed under the type C belly, which is the category of major overlap, and also because of a number of melanistic specimens in the American samples. Again it is the trend that is important.

Sexual dimorphism of the marginal wing coverts is somewhat obscured by the fact that the extremes in variability of this character, unmarked cream and unmarked dusky, do not appear to segregate sexually but do show a marked geographic difference. The type III covert, unmarked cream, constitutes 38 per cent of the adult Asiatic male sample and 35 per cent of the adult female sample; the type IV covert, unmarked dusky, constitutes 8 per cent of all North American adult males and slightly more than 8 per cent of all adult females. Both of these extremes occur on only one side of the Bering Sea.

In the Canadian samples more than 91 per cent of the adult males are separable from more than 27 per cent of the adult females on the basis of covert types I and II; in the Alaskan samples about 77 per cent of the adult males are separable from 44 per cent of the females; and in the Asiatic sample 38 per cent of the adult males are different from 45 per cent of the females. This variational trend is the same as that of belly pattern.

When percentages of difference between the sexes are calculated for head types, the same trend is again shown. In the Canadian samples 95 per cent of the males are different from 40 per cent of the females; in the Alaskan samples about 89 per cent of the adult males are separable from more than 53 per cent of the females; and in the Asiatic sample 65 per cent of the adult males are different from 75 per cent of the adult females.

The geographic trend in sexual divergence of tail pattern is more or less concordant with that of sexual dimorphism of size, although the latter is not as definitely clinal in nature as the former because of the disruption produced by the pronounced sexual dimorphism in size of the Aleutian-southwestern Alaskan population. In general, however, both males and females are more homogeneous for these characters in Canada, less so in Alaska (with the exception just above), and still less so in Asia. Assuming that these two characters are genetically independent, the phenotypic evidence indicates two parallel trends of gene frequency through the populations.

The close geographic concordance in the trend of sexual dimorphism of the belly pattern, marginal wing coverts, and head types is probably not to be construed as evidence of three parallel trends of gene frequency. Since the variability of these characters depends upon the degree of pigmentation generally in feathers, not upon specific local modifications, it seems most reasonable to suppose that they are determined by the

same genetic and physiological factors; hence, they probably indicate but a single trend of gene frequency.

MELANISM

Extreme melanism, that is, pigment saturation to the virtual obliteration of pattern, is not found in the Asiatic sample. It has already been pointed out, however, that melanism in *Buteo lagopus* is a matter of degree and that the dark phase grades continuously into the light phase. The type C dorsum, for instance, is patterned but it is also quite dark, and it could be considered melanistic on a relative basis. It has about a 12 per cent occurrence in the Asiatic sample; in this group only those individuals that have light areas on their primaries can be distinguished from Canadian specimens.

The uniformly dark examples at the extreme of the color continuum occur at different frequencies over the breeding range in North America. The situation is somewhat like that found in fulmar populations (Fisher, 1952), another species that shows the nondisjunctive kind of polymorphism. Thus, in the Aleutian-southwestern Alaskan sample the extreme melanistic individuals comprise about 19 per cent of the total, in northwestern Alaska about 7 per cent, in western Canada only 3 per cent, but in eastern Canada almost 12 per cent.

Beebe (1907:10) observed that the melanistic type has a center of abundance in Ungava and Labrador, and Grinnell (1909:213), finding dark birds from Glacier Bay, Alaska, identical to these dark eastern Canadian birds, suggested "that this 'dark phase' is really a geographic form occurring in regions of excessive humidity, and not identical with the 'light phase' . . ." Disregarding any taxonomic implication of Grinnell's statement, one does see a fairly good correspondence with Gloger's rule in this case.

ALLOCATION OF INDIVIDUAL SPECIMENS

Grinnell (1918:505–507) was one of the earliest antagonists of the idea of applying trinominals to individual specimens without regard to the geographic area from which they were taken. Now, nearly forty years later, the cogency of this position is not yet thoroughly appreciated by all ornithologists. For instance, the American Ornithologists' Union Check-list (1931) and its later supplements still contain a number of extralimital subspecies based on one or a few specimens. Unless such specimens can be demonstrated to fall entirely outside the range of variability of conspecific American forms, I fail to see any validity in their trinominal designation. Perhaps no one now disagrees with this statement in principle, but it is certainly violated in practice.

I have personally examined nine of the Alaskan specimens of *Buteo lagopus* that have been called *pallidus* or *kamtschatkensis* by one authority or another. Bailey (1948:181–182) lists five that I have not seen: DMNH 22868, 22869, 24590, 24589, and one in the Peet collection. In addition, there are two from Hooper Bay (Brandt, 1943) and one from St. Lawrence Island identied by Friedmann (Murie, 1936:367).

Specimen number 81215 USNM is the basis for the first published record of *pallidus* from Alaska (Friedmann, 1934:246). It is recorded as a male (Bailey, 1948:182, refers to this bird as a female), collected by E. W. Nelson at St. Michael's Alaska on September 16, 1879. Although not stated by Friedmann, the specimen is clearly in juvenal plumage. It has a light head, a very large continuous belly band, a distal field of brown on the tail becoming reddish proximally, and the third, fourth, fifth, and sixth primaries (from the outside) have a light reddish area on their outer webs distal to the ends of the coverts. In not one character of the plumage is it like an Asiatic juvenile; it is, in fact, indistinguishable in plumage from many juveniles from the Aleutian Islands and southwestern Alaska. It happens to be the largest specimen of any sex that I have meas-

ured from North America, with a wing of 470 mm. On this basis, it is almost certainly incorrectly sexed.

Bailey's first breeding record of *pallidus* is based on DMNH 22614, an individual taken with young at Golovin Bay, Seward Peninsula, on July 26, 1921. This specimen has been recorded both as a male (Bailey, 1942:305–306) and as a female (Bailey, 1948:182). I have not seen this specimen, but I have examined an unnumbered adult male from the Denver museum taken at the same locality on July 26, 1923. This specimen bears the name *pallidus* on its label. It looks very much like several males in the American Museum of Natural History taken on Bering Island; but it is also indistinguishable from several specimens taken in the Canadian Arctic. It has none of the exclusively Asiatic characters such as marginal covert type III or primary type I; in fact, its primaries are the extreme American type IV.

The second breeding record mentioned by Bailey (1948:182) is based on Chic. Acad. Sci. 4211, a female taken with eggs in the Romanoff (Romanzof?) Mountains of northern Alaska. Friedmann identified this bird as belonging to the Asiatic subspecies (*pallidus* or *kamtschatkensis*?). Again on the basis of plumage (see fig. 6), I would consider this bird to be a juvenile just beginning molt. The old feathers are much faded and worn and superficially resemble the light brown condition of most Asiatic birds, but the new feathers, clearly visible in the figure, are dark like most North American examples.

The same age and plumage conditions are evident in: DMNH 19522, a female from the Chipp River taken on May 24, 1938; DMNH 22867, a female taken at Wainwright on June 15, 1942; UMMZ 121719, a male taken at Brownlow Point on April 10, 1944; MVZ 32253, a male taken on the Kowak (Kobuk) River on May 10, 1899—the condition of the latter specimen having already been noted by A. H. Miller (quoted by Bailey, 1948:181).

DMNH 23645, an adult male taken at Point Barrow on June 9, 1943, has wide white margins on the feathers but is otherwise quite dark. It matches a few specimens from both Asia and Canada. DMNH 22866, an adult male from Wainwright taken on June 15, 1942, represents the extreme male example of depigmentation (see fig. 2). Birds approaching this extreme are more frequent in the Bering Sea regions of both continents, but several examples were also seen from the Canadian arctic.

Thus, it would appear that the grounds for considering any American specimen of *Buteo lagopus* as an example of the Asiatic subspecies are extremely weak, being based for the most part on an inadequate understanding of the nature of variation in this species. On the other hand, the presence of characters common to populations on both sides of the Bering Sea indicates that there is now, or has been, some genic exchange between the continents, but this does not mean that one can equate these populations taxonomically, or for that matter, genetically. The distribution of a character, or a group of genetically dependent characters, can be objectively determined, but the distribution of a subspecies is a matter of opinion and depends upon what combination and degree of expression of characters is used to characterize it.

DISCUSSION

Wilson and Brown (1953) have recently stressed examples to show the frailties of the subspecies concept. They particularly emphasize the lack of geographic concordance among infraspecific populations of characters presumed to be genetically independent, and they suggest that where populations are isolated or are undergoing secondary intergradation, the best, but still not entirely satisfactory, way to define a subspecies is in terms of peaks of character concordance.

In the case of *Buteo lagopus* it is, first of all, difficult to say which of the several characters that have been studied are genetically independent. One can presume by extrapolation from genetic studies of other species that the mensural characters are independent of plumage, but within these two groups it is not possible to know whether geographically concordant characters are genetically independent or not. I am inclined to doubt that there could be complete genetic independence of any character from another within these two groups. On the other hand, when characters are not geographically concordant, at least partial genetic independence seems assured, assuming that the characters are heritable.

Size of wing concords geographically with size of tarsus in both males and females; but the sexes are geographically discordant, that is, a population with females that possess relatively large wings and tarsi may have males that possess relatively small ones.

Among plumage characters, primaries of types I and II concord geographically with dorsal and breast colors of type A and with type III marginal wing coverts; type IV primaries concord well with dorsal and breast colors of types C and D and with marginal wing coverts of types II and IV, but the correspondence is never perfect.

A number of clines are indicated within the geographic area covered by this study. In general they parallel each other along an east-west line. Wing length of males shows a tendency toward increasing size in a westerly direction. The females show no mensural clines. There is, however, a tendency for the sexes to become less dimorphic in size from east to west, excluding the Aleutian-southwestern Alaskan population.

Nearly all the plumage characters are to some extent clinal. The light-headed individuals increase in frequency in a westerly direction; the same is true of light brown dorsal and ventral pigments. The light patch on the outer webs of primaries, the narrowly streaked breast, and the widely edged dorsal feather all follow this trend. Of even greater importance, however, is the fact that sexual dimorphism of plumage also follows this cline. The greatest sexual divergence of plumage occurs in eastern Canada and breaks down progressively toward Asia, again excluding the Aleutian-southwestern Alaskan sample in some cases.

There is one plumage character in which the extremes are restricted to one side of the Bering Sea or the other: the type III marginal wing covert is restricted to Asia, and the type IV covert to America. Primaries of types I, II, and III have a major disjunction in frequency between the Asiatic and Alaskan populations and do not exist at all in the Canadian ones.

Two American samples, the Aleutian-southwestern Alaskan and the eastern Canadian, are more homogeneous in phenotype than the other two, the western Canadian and northwestern Alaskan. The northwestern Alaskan sample in particular is extremely variable in both mensural and plumage characters. Some individuals of this population are nearly identical with the most frequent Asiatic type, a much larger number are identical with the usual Canadian examples, some are blending intermediates between these two, while others show a non-blending combination of characters. Nearly the full range in variability of each character is to be found in this population.

The Asiatic population, as examined by me, is also quite variable. This is probably the result in part of the large number of winter specimens that are included—a sample that undoubtedly contains a mixed aggregate of breeding populations. Dementiev *et al.* (1951:314) indicate that the pale-colored Asiatic form is rather homogeneous over most of its breeding range from the Anadyr to the Yenesei River, where it intergrades with typical *lagopus*. But the nature and areal extent of this intergradation, as well as that between the pale form and the so-called *kamtschatkensis*, is not stated. What appear to

be hybrids between the pale form and the darker American form occur in eastern Asia. Of the few breeding specimens examined, there are two such birds from the Lena River, the most westerly locality, and four from Bering Island. A number of winter specimens from Manchuria were also examined. All these breeding and wintering specimens fit Dementiev's description of *kamtschatkensis*, which appears therefore to be nothing more than one of the mixed types produced by crossings between the pale form of interior Asia and the American form. The Asiatic character most often expressed in such specimens is the light area on the outer webs of the primaries; the American characters most often expressed are dark color and variegation of the back, but the variability is great. Most of them appear distinctly more American-like than Asiatic, which suggests that the determiners of the pale characters are easily dominated by corresponding American ones.

On the basis of the samples examined by me, I believe that the entire population of the Bering Sea coasts and the immediately adjacent Arctic Ocean will prove to be practically indistinguishable from that of northwestern Alaska, both showing to some degree the full range of variability of the entire Asiatic and North American populations.

Such variability indicates that the Bering Sea region (excluding the Aleutian Islands) is a zone of allopatric hybridization or secondary intergradation (Mayr, Linsley, Usinger, 1953:101). The pale Siberian form and the darker, "polymorphic" American form, once separated by an extrinsic barrier, have since been able to disperse into the range of one another and there freely to interbreed. That completely random breeding occurs is indicated by the observations previously mentioned along the Colville River in 1952, where melanistic individuals were mated with very pale birds and all sorts of intermediates between these extremes occurred in the breeding population.

Although on the basis of the distribution of specific characters one can say that there is or has recently been gene flow between the continents, nevertheless on an inferential basis there are reasons for believing that the present rate of genic exchange is much less than that occurring between confluent populations on the continents. In other words, the Bering Sea now acts as a barrier to gene flow to some extent. The northwestern Alaskan population, although showing nearly the complete range of variability of the Asiatic and American forms, still has a preponderance of American types. The converse appears to hold true in Asia. Why is this so?

If one looks at a small scale map of the North American and Asiatic continents, he will see that in the region of their closest juxtaposition, namely, Bering Strait, they are opposed by a very limited coast line, which on both continents very quickly recedes away from the zone of near contact, both to the north and to the south. Thus, from a continental point of view, only a very small portion of the breeding ranges of Asiatic and American rough-legs are in near contact, and hence relatively few individuals are geographically situated for dispersal across the Bering Sea. This is one possible factor now operating to limit, but not necessarily to exclude, gene flow between the continents.

Another is the Bering Strait itself. The breeding grounds of *Buteo lagopus* are not continuous between Asia and America. They are separated by a narrow stretch of water, which again remains narrow in a very limited area only. I do not doubt that it is easily within the flying capability of *Buteo lagopus* to cross Bering Strait or even probably the widest expanse of the Bering Sea. On the other hand, Rudebeck (1950; cited by Thompson, 1953:173) has found that buteos in general show more reluctance to cross the sound between Sweden and Denmark than some other species of falconiforms during the fall passage, indicating the possibility that buzzards have an aversion to flight over water. Still, the species is well distributed in the Aleutian Islands as far out as

Umnak Island, the western limit of the distribution of voles (O. J. Murie, unpublished data), which are the principal prey of *Buteo lagopus*.

The weather of the Bering Sea could well be an additional factor discouraging passage. Frequent low fogs reduce visibility, and high winds of gale force, or stronger, make for difficult flying.

All these extrinsic factors probably sum up to reduce gene flow between the continents. Thus the perimetric populations of the Bering Sea should receive numerically greater genic contributions from the populations of their respective hinterlands than from each other.

On the other side of the picture, there are some intrinsic factors concerned with population structure that may tend to restrict gene flow over any large, continuous range of the species. Miller (1947:186–190) has presented an excellent discussion of some of these factors. It would be advantageous to be able to define panmictic populations of *Buteo lagopus* in genetic terms; this, of course, is impossible. But one can make some statements about the factors that probably influence panmixia in this species.

The breeding Rough-legged Hawk is a highly territorial individual, and pairs normally return to the same nesting area year after year; there is, therefore, little gene movement within the breeding population. Panmixia can be achieved only by the dispersal of non-territorial individuals, a situation that is widespread among avian species as pointed out by Miller (*op. cit.*:187). It becomes important to know two things about the dispersal of these unattached hawks: how far do they disperse, and how many of them reach the status of effective breeding individuals?

One can only guess at answers to these questions. The vagility of the species is great. It is not at all unlikely that a bird reared in Ungava, that migrated into the United States for the winter, could turn up the next spring in northern Alaska. It is within its physical capacity. On the other hand, nothing is known about the "homing" inclination of this species or to what extent geographic populations follow definite routes of migration. In all probability most immature birds return to the general region if not to the specific locality where they were reared.

But immature birds and other unmated individuals returning to the breeding grounds find a rigidly fixed population structure that nearly always occupies all the optimal breeding niches. A few of them gain entrance into this fixed social structure through the death of mated birds, but most of them must either remain unmated or occupy marginal breeding sites. In either case they contribute little to the reproductive success of the species. If Rough-legged Hawks are like most other falconiforms, these unmated individuals do not take up definite territories but tend instead to wander widely. Thus, even if homing is a factor tending to insure the return of the immature bird to its native region, once there it is more or less forced to move out. If these factors have been correctly interpreted, then the general movement of this dispersive segment of the summer population would be centrifugal, and one would expect to find the largest number of unmated birds and marginal pairs at the perimeter of the breeding range. There are no data for *Buteo lagopus* to support or to deny such a pattern of dispersion, and it would be difficult to show even if there were a large amount of comparative population data from different regions because the breeding distribution is itself essentially perimetric with respect to the North American continent. In the case of the Peregrine Falcon, a species with a much less linear breeding distribution in northern latitudes and one for which there are comparative population data (unpublished personal observations), there is indeed a higher incidence of marginal nestings and unattached individuals in the perimetric population compared to a more centrally located one. But despite the

questions concerning dispersion of unattached Rough-legged Hawks, one can say that the distance between the site of hatching and the site of breeding of any individual would seem to be determined largely by the essentially random occurrence of an available breeding niche into which the wandering individual could fit.

The number of birds available for dispersal is also a factor influencing the rate of gene flow. Neither the annual mortality of the population nor its annual reproductive success are known, but judging from the reports of Barth (1952) and Dementiev *et al.*, 1951), its reproduction in Scandinavia and arctic Russia fluctuates with the basic fluctuation in the numbers of microtine rodents. I would be surprised if more than 20 per cent of the fledged young reach breeding age on the average. It is quite likely to be lower. If a Rough-legged Hawk survives its first year, it has a life expectancy quite long for a bird—probably on the order of 10 years. When the annual decline is less than the annual increase over a number of years, there accrues in the population a segment of "reserve breeders"—highly mobile individuals capable of reproduction when the opportunity is afforded by the vacancy of a breeding niche. It is this segment of the population that is the effective mechanism of gene distribution. It probably renders the entire North American population potentially panmictic under the presently existing environmental conditions.

HISTORICAL INTERPRETATION

The present information about the populations of *Buteo lagopus* in the Bering Sea region suggests that there has recently been a slow amalgamation of what were formerly extrinsically separated populations. If this is true, then one should expect that formerly there existed a barrier to the dispersal of populations. The history of events in the Bering Sea region during the Pleistocene glaciations provides such a situation.

Current geological theory (see Flint, 1947, for review) supposes that during the Pleistocene much of the Bering Sea basin and the immediately contiguous basin on the Arctic Ocean alternated between dry land status, correlated with periods of maximal glaciation when sea levels were low, and inundation during interglacial periods when sea levels were high. The former concept of the Bering Strait "land-bridge" has thus gradually metamorphosed into the idea of the "Bering Sea-Yukon refugium," an essentially unglaciated region of large extent roughly following the continental shelves, confluent with the lower river valleys, and well isolated from the rest of the coeval North American biota by several thousand miles of ice. It was not, however, isolated from the large unglaciated region of Siberia, which is inferred to have existed during the maximum of the Wisconsin (last) glaciation (see plate 3 of Flint, 1947). Other refugia of the northern biota are inferred on the basis of both geological and biogeographical evidence to have existed as isolated entities to the southwest and to the southeast of the great continental ice sheets.

The theory of biotic refugia within the glaciated regions was first clearly stated by Hulten (1937), primarily based on biogeographical data, and it was used by him and later by Raup (1946) to explain the phytogeographic patterns of present boreal floras. It has also provided a basis for cogent interpretations of certain trends in speciation among northern groups of birds (Rand, 1948; Pitelka, 1950) and mammals (Rand, 1954). Drury (1953) has shown a correspondence between the geographic affinities of plants in the St. Elias region of Yukon Territory and the geographic affinities of the birds there, based on Hulten's original scheme.

In all likelihood the Yukon-Bering Sea refugium provided suitable conditions for a breeding population of Rough-legged Hawks. Such a group of birds must have been completely cut off from the rest of the North American populations, which then resided

in refugia far to the south of their present breeding ranges. This Alaskan population, however, would have been continuous with the Asiatic one at this time, presumably sharing the characters now most typical of the pale Siberian form.

During the retreat of the last glaciation, one or more biotic corridors opened up gradually between the unglaciated southern regions of North America and the unglaciated region of Alaska and the Bering Sea. At the same time, the rising sea began to invade the basins that are now covered by the northern part of the Bering Sea and the contiguous Arctic Ocean. The first effect of this deglaciation allowed an avenue for dispersal of both Alaskan and North American Rough-legged Hawks. The latter, being a larger population, probably effected a faster and numerically greater dispersal than did the peripherically situated Alaskan hawks, which for a time may have maintained migratory affinities with the rest of the Asiatic population by crossing over the invading Bering Sea.

As the melting of the glaciers continued, the Bering Sea and the Arctic Ocean began more and more to separate the two continents, making it increasingly less likely for birds wintering in Asia to cross into Alaska. More and more voids were thus left in the ecologic niche occupied by *Buteo lagopus* in Alaska, and these were probably taken up by dispersing individuals from the North American population. But this displacement probably did not take place rapidly, and there was plenty of time for the two continental populations to mix their genes thoroughly in the zone of contact in Alaska. Some of this mixture was carried over to the Asiatic side of the Bering Sea before the continents were completely isolated by water, and as already indicated there has probably continued to be some admixture of Asiatic and North American genes right up to the present. The result is now a thoroughly hybridized population on both sides of Bering Strait, the "foreign" genes gradually being swamped out in the more interior segments of the continental populations.

The Aleutian Islands and southwestern Alaska were probably repopulated by Rough-legged Hawks following the retreat of the glaciers from a population that had been isolated in the refugium to the southwest of the ice sheets. These birds may have undergone change in the direction of greater saturation of pigment in the refugium, or they may not have done so until after establishment in the Aleutian Islands. In either case, on the basis of their characters, one can say that they do not appear to have been derived from the same recent stocks as either the northwestern Alaskan or the eastern Canadian populations.

The breeding populations of Canada were probably derived from birds residing in a refugium to the southeast of the ice sheets. These Rough-legged Hawks may have undergone a somewhat parallel change in the direction of pigment saturation, or again they may not have been modified until after their dispersal into Canada following the retreat of the glaciers. Alternatively, saturated pigmentation may have been common in all populations of *Buteo lagopus* prior to their isolation in refugia during the Pleistocene and then have been virtually lost in some populations during isolation.

While this suggested picture of the history of the Rough-legged Hawk populations in North America during late glacial and postglacial times is consistent with what is known about glaciation and the present patterns of geographic variation in the species, it must be considered a highly tentative model. Any attempt at a reconstruction of the history by indirect methods is subject to great and indeterminate error.

TAXONOMIC RECOMMENDATIONS

It should now be abundantly clear that attempts to describe subspecies of *Buteo lagopus* based on a few specimens, with no consideration of variation over the whole

range of the species, are misleading. Indeed, the patterns of variation manifested by the various characters of *Buteo lagopus* are ill-suited to the trinominal system because the so-called peaks of concordance are not conspicuous and because the variability of the characters at any given geographic locus is great. Clear-cut geographic differences simply do not exist except, perhaps, on a continental basis. I therefore suggest the following modifications of the existing taxonomic treatment of this species. The name, *sanctijohannis*, should be restricted to the breeding populations of Canada east of the Mackenzie River. Possibly the Aleutian-southwestern Alaskan population might be included to make a polytopic subspecies, but this I feel is not meaningful since the variation of this population suggests that it has undergone independent though somewhat parallel evolution at least since late Wisconsin time. Its distinctness is not, however, sufficient for subspecific recognition. The regions contiguous to the Bering Sea (excluding the Aleutians) and the adjacent Arctic Ocean should be considered a zone of hybridization, and birds from these areas should not be trinominally designated. The population of Kamchatka and adjacent regions falls in this same category, and thus *kamtschatkensis* in the sense of Dementiev should not be considered a valid subspecies. The name, *kamtschatkensis* Dementiev, therefore, becomes the first available synonym to replace *pallidus* Menzbier, as already recognized in the Twenty-third Supplement to the A.O.U. Check-list (*loc. cit.*), and the name, *menzbieri* Dementiev, newly proposed, should become a synonym of *kamtschatkensis*. Admittance of the Siberian subspecies to the North American list (Wetmore *et al.*, 1945) should be revoked since there is no unambiguous demonstration that examples unquestionably from Asia have occurred in Alaska.

SUMMARY AND CONCLUSIONS

The Common Rough-legged Hawk (*Buteo lagopus*) is a polytypic species, three or four subspecies currently being recognized. The present study was undertaken to determine the nature of the variation of this species in North America. A sample of Asiatic birds was also employed for comparative purposes.

Molt occurs from April until late fall, but is accomplished mainly during the breeding months of June, July, August, and early September. Males tend to molt later than females, and it is suggested that this is an adaptation to the primary role that the male assumes as food provider for the female and young during the first half of the breeding season.

Juveniles are best distinguished from adults by differences of pattern and color on the tail and belly. Adult males are more distinct from juveniles than are adult females. There is no clearly defined second-year plumage, but there may be some minor changes of plumage correlated with age.

The so-called polymorphism of the Common Rough-legged Hawk is nondisjunctive in nature, and the darkest extremes grade in unbroken series to the lightest extremes.

The individual variability of *Buteo lagopus* is so great as to preclude definitive study of variation without large series of skins.

Female Rough-legged Hawks are larger than males, but there is much overlap between the sexes for all measurements studied except that of gross body weight, for which no overlap is indicated. The adult plumage is also sexually dimorphic, a condition that has not heretofore been noted. Tail and belly patterns are the best indicators of sex, but head type, marginal wing coverts, and colors and patterns of the dorsum are also to some extent different.

There is remarkably slight geographic variation in mensural characters. No populations are clearly distinguishable on the basis of measurements used in this study. Geo-

graphic variation of plumage characters tends to show an east-west cline. Most characters parallel each other, but some are inversely related. The greatest disjunctions in the variation of characters usually occurs between Alaska and Asia.

Sexual dimorphism of size varies geographically, the most dimorphic population being in the Aleutians and southwestern Alaska, but the general trend seems to be toward lesser sexual dimorphism from eastern Canada west into Asia. Sexual dimorphism of plumage also varies geographically and shows an even greater tendency to break down in a westerly direction. The east Canadian population is the most sexually divergent in plumage.

Extreme melanistic examples appear to be more frequent in regions of high humidity, that is, in the Aleutians and southwestern Alaska and in Ungava and Labrador, but they occur at a low frequency throughout the breeding range in North America.

There is little geographic concordance of characters presumed to be genetically independent, and peaks of character concordance are not therefore definable.

Populations inhabiting regions adjacent to the Bering Sea show nearly the full range in variability of each character of both the North American and Asiatic populations, a condition that indicates a zone of hybridization. Even so, the continental configurations of Asia and North America, the interposition of the Bering Sea, and perhaps weather still appear to act in combination as an extrinsic barrier against free population dispersal. Structure of the breeding population may also limit dispersion in continuous continental populations, but the presence of a small, highly mobile reserve of potential breeders probably renders continental populations essentially panmictic.

During the Wisconsin glaciation, "Alaskan" Rough-legged Hawks inhabiting the Yukon-Bering Sea refugium were probably panmictic with Siberian ones. Amalgamation of this isolated population with more southern North American ones probably took place slowly as they came into contact through corridors which opened up with the retreat of the ice caps. It appears that the North American population by virtue of its greater numbers has contributed the largest amount of material to the gene pool in the Alaskan zone of hybridization.

The name *sanctijohannis* should be restricted to the breeding population of Canada east of the Mackenzie River. Specimens from regions contiguous to the Bering Sea and the adjacent Arctic Ocean should be considered intergrades and should not be trinominally designated. The form *kamtschatkensis* Dementiev, *sensu stricto,* is not distinguishable from the Siberian form and this name is therefore the first available to replace *pallidus* (Menzbier) for the Siberian subspecies. The Siberian subspecies should be deleted from the North American list since there is no unequivocal demonstration of its occurrence in that region.

LITERATURE CITED

American Ornithologists' Union Committee.
1931. Check-list of North American birds. Fourth Edition (published by the Union, Lancaster, Pa.).

Bailey, A. M.
1942. Siberian rough-legged hawk in northwestern Alaska. Auk, 59:305.
1948. Birds of arctic Alaska. The Colorado Museum of Natural History, Popular series, No. 8.

Baldwin, S. P., Oberholser, H. C., and Worley, L. G.
1931. Measurements of birds. Sci. Publ. Cleveland Mus. of Nat. Hist., Vol. 2.

Barth, E. K.
1952. Breeding biology of the rough-legged buzzard and variations in the population in 1938–1952. Papers on Game Research, 8:127–138.

Beebe, F. L.
1953. The Peregrines of the northwest coast. Falconry News and Notes, 1(1):5–11.
Beebe, W.
1907. Geographic variation in birds with especial reference to the effects of humidity. Zoologica, 1:1–41.
Bent, A. C.
1937. Life histories of North American birds of prey. Part I. U. S. Nat. Mus., Bull. 167.
Brandt, H.
1943. Alaska Bird trails (The Bird Research Foundation, Cleveland).
Dementiev, G. P.
1931. *Buteo lagopus kamtschatkensis*, subsp. nova. Ornith. Monatsb., 34:54–55.
Dementiev, G. P., Gladkov, E. C., Ptushenko, E. C., Spangenberg, E. P., and Sulilovokaya, A. M.
1951. Birds of the Soviet Union. Vol. I (Government Publ. Soviet Sci., Moscow; in Russian).
Drury, W. H., Jr.
1953. Birds of the Saint Elias quadrangle in southwestern Yukon Territory. Canadian Field-Nat., 67:103–128.
Fisher, J.
1952. The fulmar (Collins, London).
Flint, R. F.
1947. Glacial geology and the Pleistocene Epoch (John Wiley and Sons, New York).
Ford, E. B.
1945. Polymorphism. Biol. Rev., 20:73–88.
Friedmann, H.
1934. The Siberian rough-legged hawk in Alaska. Condor, 36:246.
1938. Stegmann on the Falconiformes of the U. S. S. R. Auk, 55:290–291.
1950. Birds of North and Middle America. Part 11. U. S. Nat. Mus., Bull. 50.
Grinnell, J.
1909. Birds and mammals of the 1907 Alexander Expedition to southeastern Alaska. Univ. Calif. Publ. Zool., 5:171–264.
1918. Concerning a certain tendency in systematic ornithology. Auk, 35:505–507.
Hubbs, C. L., and Perlmutter, A.
1942. Biometric comparison of several samples, with particular reference to racial investigations. Amer. Nat., 76:582–592.
Hultén, E.
1937. Outline of the arctic and boreal biota during the Quaternary Period (Bokförlags Aktiebolaget Thule, Stockholm).
Huxley, J.
1942. Evolution, the modern synthesis (Harper and Brothers, New York).
Macoun, J., and Macoun, J. M.
1909. Catalogue of Canadian birds (Canadian Geological Survey, Ottawa).
Mayr, E.
1942. Systematics and the origin of species (Columbia University Press, New York).
Mayr, E., Linsley, E. G., and Usinger, R. L.
1953. Methods and principles of systematic zoology (MacGraw-Hill Book Company, New York).
Mayr, E., and Stresemann, E.
1950. Polymorphism in the chat genus *Oenanthe* (Aves). Evolution, 4:291–300.
Miller, A. H.
1947. Panmixia and population size with reference to birds. Evolution, 1:186–190.
Murie, O. J.
1936. The birds of St. Lawrence Island, Alaska. Appendix V in: Archaeological excavations at Kukulik, St. Lawrence Island, Alaska, by O. W. Geist and F. G. Rainey. University of Alaska Misc. Publ., 2:361–375.

Nelson, E. W.
1887. Report upon natural history collections made in Alaska between the years 1877 and 1881. Government Printing Office, Washington, D.C.
Pitelka, F. A.
1950. Geographic variation and the species problem in the shorebird genus *Limnodromus*. Univ. Calif. Publ. Zool., 50:1–108.
Rand, A. L.
1948. Glaciation, an isolating factor in speciation. Evolution, 2:314–322.
1954. The ice age and mammal speciation in North America. Arctic, 7:31–35.
Raup, H. M.
1946. Phytogeographic studies in the Athabaska-Great Slave Lake region, II. Jour. Arnold Arboretum, 27:1–85.
Reilly, E. M., Jr.
1954. Bird records and the A.O.U. Check-list ranges. Auk, 71:156–163.
Simpson, G. G., and Roe, A.
1939. Quantitative zoology (McGraw-Hill Book Company, New York).
Stegmann, B.
1937. Faune de l'U.S.S.R. sous la direction de S. A. Sernov de l'Academie redige par A. A. Stackelberg. Oiseaux, vol. 1, no. 5. Falconiformes. Moscow. (In Russian.)
Thompson, A. L.
1953. The study of the visible migration of birds: an introductory review. Ibis, 95:165–180.
Wetmore, A., *et al.*
1945. Twentieth supplement to the A.O.U. Check-list. Auk, 62:436–449.
1948. Twenty-third supplement to the A.O.U. Check-list. Auk, 65:438–443.
Wilson, E. O., and Brown, W. L., Jr.
1953. The subspecies concept and its taxonomic application. Systematic Zoology, 2:97–111.
Witherby, H. F., Jourdain, F. C. R., Ticehurst, N. F., and Tucker, B. W.
1939. The handbook of British birds. Vol. 3 (H. F. and K. Witherby, London).

Department of Zoology, University of California, Los Angeles, California, March 15, 1955.

HISTORY OF THE NESTING OF AN ANNA HUMMINGBIRD

By JUNEA W. KELLY

When on the afternoon of January 4, 1954, I saw an Anna Hummingbird (*Calypte anna*) investigating the very slender twigs of an evergreen tree (*Azara microphylla*) growing in the corner of my garden in Alameda, California, I hoped she was planning to nest in this location. Several times she flew to a *Tamarix parviflora* a few yards away and returned to the *Azara* as if she were carrying nesting material. Three days later I again saw her, and a minute swelling was apparent on a vertical twig. The site of the nest was 25 inches from the sleeping porch wall, which consists of translucent windows, and 4 feet from the bathroom window from which most of the observations had to be made. The nest could also be observed from a garden walk 6 feet distant. In order to obtain a clearer view of this spot I parted the sash curtains 2 inches while she was away; upon her return she appeared to notice this change and left immediately. When the gap was closed, she returned. As there are enough natural causes that could spell failure for a nest, I did nothing that might discourage her, especially during the early stages of building. I realized that the short winter days would make it possible to watch the nest from dawn to dark. Also the season of the year with its abrupt weather changes would give an opportunity to see the bird's reaction to frosty mornings, strong winds, and heavy rains.

The weather was favorable for a successful nesting. Rainfall was below normal—2.85 inches in January and 1.93 inches in February. Temperatures were above normal. The average maximum for January was 55.4°F. and the minimum 41.5°. The highest temperature for January was 64°, the lowest 32°. For February the average maximum temperature was 61.1°, the minimum 41.5°. The highest February temperature was 77° and the lowest 36°. The figures for temperature and rainfall given here are those recorded at the Oakland Airport (U. S. Weather Bureau, 1954).

Although the Anna Hummingbird is a common permanent resident of the San Francisco Bay region and frequents human habitations, as far as is known there is no account of a complete history of the nesting of this species. This is surprising when one considers the long nesting season from early December (Bent, 1940:373; Dawson, 1923: 944) through August (Trousdale, 1954:110) and the fact that there are frequently two broods. This is still more surprising in view of the fact that Grinnell (1924:201) found the Anna Hummingbird ranked eighth among the ten most celebrated birds in California in the number of times its name had appeared in the titles of published articles.

NEST CONSTRUCTION

The nest tree was situated in a corner of the garden, recessed 10 feet from the west end of a sleeping porch and 7 feet from the north side of the house. No direct wind from the south or east could strike the nest. The top of the slender, 17-foot tree had upright pinnately-branched shoots. These projected above the porch roof so that they caught the wind from all directions except the east. Along the trunk the branches were pendulous. The trunk of the tree was only 8 inches in circumference at the ground and 5 inches in circumference 9 feet from the ground; at this point the nest branch curved out from the trunk. The branch was ¾ inch in circumference. Thirty inches from this junction the nest was built, and the branch was only ⅜ inch in circumference at the top of the nest. All the pendulous branches curved toward the trunk of the tree at their lower extremities. As she built, she incorporated on either side two smaller twigs of this vertical branch and built down to the bottom of the curve, giving the nest three

ribs for support. Usually this species begins nest building with a platform. After she reached the bottom of the curve, she built the rest of the cup. No matter how much the tree trunk and the pendulous branch swayed, the nest never tipped but swung in an arc like a pendulum. Even at night I could watch the pendulum-like swing of the nest as a streetlight shone upon the nest tree and branches, which cast shadows upon the windows of the sleeping porch.

The bottom of the nest was 7 feet from the ground. The outside dimensions of the nest were: top, 1¾ inches in diameter; depth, 1⅝ inches. The end of the little branches on which the nest was built projected 7 inches beyond the bottom of the nest. From above the nest was completely exposed. The leaves of the *Azara* are shiny and narrow, ¾ inch long, with stipules half as long. Fine leafy twigs screened the nest from west and north so that the free approach to the nest was from the corner of the house.

When completed the nest looked like the typical nest of an Allen Hummingbird (*Selasphorus sasin*). Aldrich (1945:137) mentions that in eucalyptus trees, nests of the Allen Hummingbirds are usually near the tips of drooping incurved branches. This Allen-type nest was another example of the great variation in nests built by Anna Hummingbirds as reported by Bent (1940:373), Dawson (1923:944), Pitelka (1951:201).

The following are a few remarks on the actual nest building. On January 9 the female was first observed at work in the morning at 9 a.m. By the 13th she started at 8:40 and was busy off and on all day. Thinking to make life easier for her, on the 15th, a hummingbird feeder and also a previous year's unfinished nest were placed near the path of her travels to and from the nest. Only once did I see her take down from the nest, and never, even when the feeder was draped with fuchsia blossoms, did I observe her using the artificial food supply. After a windy night followed by rain on the 16th she came at 8:50 a.m. Her arrival in the morning evidently depended somewhat upon the weather. On the 18th she arrived at 7:50 and worked all day. She often returned so quickly on this date that the building material must have been obtained nearby. She was frequently seen working halfway up the periphery of a 70-foot redwood tree (*Sequoia sempervirens*) in an adjoining garden where she was probably gathering nesting material as well as food. These observations were made from a second-story window. The distance from the redwood tree to the nest was 65 feet. On the 19th she was not seen. I looked into the nest and saw it was well lined. In order to look into the bottom of the nest I had to put up a short ladder against the wall of the house. The nest seemed finished. Perhaps she was not ready to lay eggs.

Because the nesting was so early in the year before vegetative growth had had an opportunity to start, I was interested to know what materials she had used in building the nest. When the nesting was over, I took samples of the trimmings, the binding material, and nest lining to the Botanical Department, University of California. After determining that the trimmings were fuchsia bark covered in many cases with a green alga, *Protococcus,* and that the lining consisted chiefly of torn-up feather down, the Department sent the binding materials to the Criminology Department. Many of the threads were identified as rodent hairs. Aldrich (1945:142) mentions that hairs of horses, dogs, and ground squirrels were contained in Allen Hummingbird nests. The down was identical with the down feathers from the quilt on the sleeping porch. I found a small amount of plant down in the nest lining that I could identify as coming from an exotic shrub (*Senecio petasites*) flowering in my neighbor's garden. Seth B. Benson of the Museum of Vertebrate Zoology also determined some of the threads as being spider webs with egg cases. Early in the season when plant down of willows (*Salix* sp.) and composites is not available, feathers are used for lining (Dawson, 1923:945).

I appreciate the identifications of nesting materials made by Helen K. Sharsmith of the Botanical Department, by Paul S. Kirk of the Criminology Department, and by Seth B. Benson of the Museum of Vertebrate Zoology, all of the University of California.

EGGS AND INCUBATION

On January 20 there was a heavy frost. The female returned at 7:45 a.m. and saw a Hermit Thrush (*Hylocichla guttata*) on the low branches of a tree two yards away. She hovered above the thrush, and it moved on. The hummingbird darted back to the nest, and later the first egg was discovered. On the 21st she was seen off and on occasionally, but still there was only one egg. The next day at 9:20 a.m. I found the second egg. She then began incubating and at 5 p.m. settled down for the night. At 7:17 a.m. on the 23rd, she left the nest for her first feeding. For the last feeding of the day she left at 5:10 p.m. and returned in 6 minutes.

When leaving the nest, she always flew into the neighbor's garden where the redwood tree grew. Never during the entire nesting period did I see her feeding in my garden except when catching insects in the air near the nest tree. A similar observation of the female feeding away from the nest area is reported by Howell and Dawson (1953:96). On the 24th it rained from early morning until into the afternoon. She would leave the nest as the rain slackened or stopped and then would return quickly. This same behavior pattern was followed all during the incubation and later when young were in the nest. If the morning were dull, cold, foggy, or rainy, the time of her departure from the nest for the first feeding was later than on clear mornings, and she came back more quickly. The weather also regulated the time of her last feeding.

HATCHING AND CARE OF YOUNG

On February 6 there was a heavy frost in the morning, and the hummingbird sat steadily on the nest with such short intervals out for feeding that not until noon was I able to look into the nest without disturbing her. Then I found one egg beginning to hatch. At 5:40 p.m. when I looked into the nest again, the first bird had entirely emerged from the egg, and no fragments of shell were visible. The 7th was another frosty morning. She left the nest at 6:37 for the first time. At 3:30 p.m. when I looked into the nest, the second egg had hatched, 16 days after incubation began.

The gray color of the young birds' down and of the nest lining was relieved by their small triangular, bright yellow bills. In feeding the young at this time the female seemed barely to touch their bills. Again a Hermit Thrush appeared, and she made it move. When the young were 6 and 7 days old, respectively, they were well covered with down and had grown so large that they could be seen from the window. The 13th was a stormy day; about an inch of rain fell. The female remained on the nest during the heavy showers and spread herself over the birds like a tent, leaving the nest only for a few minutes when the rain slackened. February 15 was clear and mild, with some clouds. The female left the nest at 6:55 a.m. and was off the nest most of the day. The gray appearance of the birds had changed to a brown, and feather tracts could be seen on their backs. Their bodies were now rounding over the nest. A light rain fell during the night of the 16th. Heavy rain accompanied by strong wind fell on the 17th. This was the last day of rain while the young were in the nest. On the 16th and 17th she did not brood during the daytime, and on the 18th she did not come back for the night. At no time after this date, when the young were 11 and 12 days old, did she brood them. This observation agrees with the findings of Howell and Dawson (1953:94).

The first time that the young were observed to try their wings was on the 20th. By this time all the feathers were developing very rapidly, and the feather tracts on the

heads were pronounced. The feather development of the young practically paralleled the development given by Orr (1939:21) for the young of the Allen Hummingbird in a May nest. All parts of the young birds did not develop with equal speed. One day the wings would make more progress, then the tail. Toward the end of the nesting the bills began growing more rapidly.

Beginning on the 19th, observations were made several times nightly with a flashlight. During the early part of the evening the young were sitting high, but as the night grew cooler, they would settle farther and farther into the nest until they had snuggled down as far as was possible. Pearson (1949:147) describes the temperature control and metabolism at night of two nestling hummingbirds and states that when 11 days old "they disclose no drop in metabolism at night."

At 7 a.m. on the 21st the young were asleep. By 7:15 they were beating their wings and were fed at 7:45. Similar behavior occurred on the following mornings. The female was becoming more alert. She now always approached the nest from above in a series of jerks as if descending an imaginary flight of stairs, constantly turning her head from side to side. She left with a long steep upglide until she cleared the wall of the house. She was now feeding the young more frequently and often took a perch on the tall bare tip of a nearby tree.

Daily the young were becoming more restless. After feeding they backed to the edge of the nest and discharged the feces by a powerful squirt, then settled in the nest for a rest. By this time a greenish cast had appeared on their wings. They were constantly changing their positions in the nest, preferring to face away from the house.

The maximum temperature on February 24 was 74°, and mild weather continued until the birds left the nest. By the 25th the female was feeding more frequently in the early morning and after 4 p.m. The young were growing so large that one bird was often lying on top of the other with wing outstretched. On this date at 5 p.m. a wing of one of the birds was hanging straight down outside the nest. At 7:30 this wing had been retracted, but the other wing was pointing upward between the two birds. At 8:30 the wing was down, and the birds were facing in opposite directions. Always as night came on, there was plenty of room in the nest because, apparently with the lowered temperature, the birds snuggled down.

It was becoming more difficult for the adult to feed the young. When they faced away from the corner of the house as she approached to feed, she would stand on the free edge of the nest, stretch her neck unbelievably long, and pull the heads of the young back with her bill. Then she would have to feed from that position.

The 25th was the date of seeing them extend the tongue for the first time. It appeared like a glistening thread. Orr (1939:24) mentions that a young Allen Hummingbird used its tongue to touch surrounding leaves. This was the only reference to the tongue that I found in the literature. On the 26th the young projected and retracted their tongues steadily for 30 minutes. It was also on this day that they began preening vigorously while on the edge of the nest.

The time was rapidly approaching for the birds to leave the nest. It seemed advisable to have someone constantly observing from daylight to dark in order to record how the young would leave the nest and to protect them from the Scrub Jays (*Aphelocoma coerulescens*) that had been seen flying past the corner. Since it was impossible for me always to stay at home, I asked several of my friends who were good bird watchers to "baby sit" during my absence. Beginning at 6:45 a.m. on February 27, and until both birds had left the nest on March 4, the nest was almost continuously under observation during the daylight hours.

At 6:50 a.m. on the 27th the young were fed. They were sitting very high in the nest and became extremely restless, scratching and preening with feet and bills. At 12:50 p.m. one young was observed for the first time standing on the edge of the nest and fluttering its wings. Shortly after, a young began reaching out with its tongue along an adjacent twig, leaning out over the edge of the nest. When at 4:25 the young were fed, the reflected sunlight through the sleeping porch windows showed orange-red bill linings. After the last feeding at 5:35 p.m. both birds settled down. Between 1:22 p.m. and 5:35 there had been 15 feedings; the longest interval between feedings was 29 minutes, from 3 p.m. to 3:29. Although there was no exact pattern, the intervals became shorter in the late afternoon with three feedings between 5:10 and 5:35. The nest began to sag on the edge where the adult was forced to stand in feeding the young. The general behavior was the same for February 28 and March 1 as on the 27th.

The activities on March 2 were much the same, only accelerated. On one occasion the adult stood on one young while pumping food into the other. On another occasion she fluttered in front of them when there was no place to alight, hovering as hummingbirds do when they are feeding before a flower. The female had repaired the sagging edge of the nest. The young used their tongues to lick all the foliage that they could reach. Jays were calling, and two came near the corner. In addition one House Finch (*Carpodacus mexicanus*), three Robins (*Turdus migratorius*), a Spotted Towhee (*Pipilo maculatus*), and several unidentified sparrows came into the corner. None was in sight when the adult returned, but a little later she chased a Spotted Towhee away. In the early afternoon one bird fluttered backward off the nest and then settled into the nest again. Both birds stood on the edge of the nest facing inward as they exercised their wings. The last feeding was at 5:25 p.m. At 6:00 all was quiet.

On March 3 both of the birds had been fed early in the morning, had been going through their usual exercises, and had then quieted down on the nest. I was away from my observation point two minutes, and in that short time one young had left the nest and perched on a nearby branch. This bird will be designated as "A" hereafter, and the bird remaining in the nest will be designated as "B." At 7:50 the adult fed both birds. At 9:27 it was observed for the first time that B noticed insects flying near the nest. Orr (1939:23) recorded a similar occurrence. During the morning A gradually became more venturesome and began flying longer distances from the nest.

From its perch A must have heard the ticking note of the female as she was coming in with food because its bill was already open before she was seen by the observer. This was the same *tick* that she had so frequently given when feeding the young. Bird A flew to within 6 inches of the nest, giving thin, uncertain notes. B gave a little cry which was followed within 5 minutes by a single, high-pitched note from A.

Early in the afternoon B was on its toes fluttering hard, and raising off its toes; it hovered a half inch above the nest for a second or two, heard the female's call note, and settled back into the nest for a feeding. Shortly afterward, B was standing on the edge of the nest reaching out to poke at twigs, and it moved its tongue over all the leaves within reach. Both birds were fed seven times between 1:17 and 3:30 p.m. and three times between 4:47 and 5:45. At 6 o'clock B settled into the nest facing the porch.

On March 4 at 6:30 a.m. B was still quiet on the nest. At 6:50 it preened and stretched its neck, then settled back. Five minutes later it fluttered, lifted itself off the nest several times, sat on the edge, then settled into the nest. At 7:00 it lifted itself 1 inch and started to back off into space. Two minutes later it was resting in the nest. At 7:10 it was just sitting; at 7:17 it was fed. At 7:20 B raised itself about 3 inches and backed off the nest toward the corner of the house, flew around the trunk of the tree

toward the sleeping porch, and perched on a limb above and in front of the nest. It then preened itself, flew up on a higher branch, and was fed five minutes later. It then flew over to the porch roof. At 7:36 the female fed A which had come in five minutes earlier. B flew around and tried several times to alight before it found a branch strong enough to support its weight. A came to the same limb, almost sitting on B; then it perched alongside of B. The female feeding the two could hardly keep a position on the limb because of its small size. The young sat only two inches apart and finally took positions on two separate limbs. I would lose them and then they would appear again, but I could no longer distinguish between A and B. I lost them at 10:50. At 5:15 p.m one young bird was sitting on a limb near the nest and was fed at 5:25 and 5:35. It was still sitting there at 6:15. At 9:45 it was settled on the limb for the night.

On March 5 the bird was still sitting in the same place at 6:50 a.m. Five minutes later it flew to a higher perch, and at 7:45 it was gone. During the afternoon of the 5th all three birds were seen and heard in the garden. Much to my surprise, at 5:40 there was a young bird on the same twig where one had spent the night of the 4th. It was fed at 5:45 and again at 6:00. I could see it by flashlight in this position at 7:30 p.m. At 6:30 the following morning, March 6, it was gone. The garage door had been open for a few minutes late the previous afternoon. When I opened the door at 8:45 a.m., I heard a persistent squeaking in the garage and looked up at the rafters, and there sat a young hummingbird. I opened the door all the way; the bird flew out and perched low on a nearby shrub still squeaking. It then disappeared in the shrubbery of the garden. At 9:45 the adult was seen feeding one young. That was the last time I saw the birds.

I am greatly indebted to Helen Anthony, Ethel Case, Linda Knudsen, and Elsie Roemer, for their diligent recordings of the activities at the nest in my absence.

OTHER OBSERVATIONS

On April 3, 1954, my neighbor discovered an Anna Hummingbird's nest built 20 feet from the ground in a live oak (*Quercus agrifolia*). By means of ladder and mirror I saw two young birds probably a few days old in the bottom of the nest. We watched the female feeding the young for two weeks. All during this time Scrub Jays were in the tree. They could look through the branches and see the nest, and the female repeatedly drove them away. On the 17th at 10 a.m. all was normal. At noon when my neighbor looked at the nest, she saw that the young were gone and that the nest lining had been pulled up. Although the jay was not actually seen taking the birds, as there were no other predators in the garden, it seemed certain that the jay had destroyed the nest. In the same garden at the end of May another Anna Hummingbird's nest was discovered well concealed in a mirror plant (*Coprosma baueri*). It was a successful nesting.

Three Anna Hummingbird nests were observed in 1955 in the same neighbor's garden. The first one was discovered on April 6, 20 feet up from the ground in the small leafy branches of a birch tree (*Betula alba*). On May 12 a second nest was discovered about 17 feet from the ground built on the tip of a redwood branch. Both of these nestings were successful. On June 27 a third nest was begun in the same birch tree, but this time on the tip of a pendulous branch 9 feet from the ground. I cannot help but conclude that nests built on leafy branches too weak to support the weight of a large bird are less likely than others to be destroyed by the jays. Edwards (1919:67) reports four nests destroyed by jays.

Again referring to the nest in the *Coprosma*, on July 4 the second bird left the nest but returned and spent the night in the nest. This was interesting because for two nights a young one had spent the night in the *Azara* near its nest.

In view of the fact that the hummingbirds in the *Azara* so continuously used their tongues and only one reference could be found in the literature regarding this behavior, I feel it is worth recording that the nestlings in the *Coprosma* also made use of their tongues.

The female from the *Azara* nest was never observed gathering food from flowers although there were many fuchsias in bloom. It had always been seen catching insects in the air and foraging in the redwood tree. This does not seem so strange when Beal and McAtee (1922:17) state that in examining the stomach contents of this species, 99 per cent of the food of Anna Hummingbirds was animal matter. Of course, the stomach contents would not show how much syrup might have been consumed. Grinnell and Storer (1924:353–354) mention that Anna Hummingbirds fed around the golden oaks in the neighborhood of El Portal during the months of November and December.

SUMMARY

An Anna Hummingbird began nest-building on January 4. The weather was favorable for a successful nesting. The nest was completed on the 19th and the first egg was laid on the 20th. The second egg was laid on the 22nd. The first hatching occurred on February 6, and the second on February 7; the incubation period was therefore 16 days. The young left the nest at the age of 25 or 26 days. They had not been brooded after the 12th day. The young birds were observed for two days after leaving the nest.

LITERATURE CITED

Aldrich, E. C.
1945. Nesting of the Allen hummingbird. Condor, 47:137–148.
Beal, F. E. L., and McAtee, W. L.
1922. Food of some well-known birds of forest, farm, and garden. U. S. Dept. Agr., Farmers Bull. 506:1–35.
Bent, A. C.
1940. Life histories of North American cuckoos, goatsuckers, hummingbirds and their allies. U. S. Nat. Mus. Bull., 176:viii+506 pp.
Dawson, W. L.
1923. The birds of California (San Diego, etc., South Moulton Co.),
Edwards, H. A.
1919. Losses suffered by breeding birds in southern California. Condor, 21:65–68.
[Grinnell, J.]
1924. Editorial notes and news. Condor, 26:201.
Grinnell, J., and Storer, T. I.
1924. Animal life in the Yosemite (Berkeley, Univ. Calif. Press).
Howell, T. R., and Dawson, W. R.
1953. Nest temperatures and attentiveness in the Anna hummingbird. Condor, 56:93–97.
Orr, R. T.
1939. Observations on the nesting of the Allen hummingbird. Condor, 41:17–24.
Pearson, O. P.
1949. The metabolism of hummingbirds. Condor, 52:145–152.
Pitelka, F. A.
1951. Breeding seasons of hummingbirds near Santa Barbara, California. Condor, 53:198–201.
Trousdale, B.
1954. Copulation of Anna hummingbirds. Condor, 56:110.
United States Weather Bureau.
1954. Climatological Data, 58, nos. 1–3.

Alameda, California, July 21, 1955.

AGE, MOLT AND WEIGHT CHARACTERISTICS OF BLUE GROUSE

By JAMES F. BENDELL

In the course of a study of the population dynamics of Blue Grouse (*Dendragapus obscurus*) at Quinsam Lake, Vancouver Island, British Columbia, data were obtained on age groups in this species. A quantitative method was developed for aging both yearling and adult grouse. In the young, feather and weight development can be used as an estimate of age from time of hatching in June to the first fall plumage of October. Observations on molt and weight of all age classes fit naturally into the present discussion.

According to Bent (1932) the juvenal plumage rapidly replaces the natal down. The juvenal flight feathers are molted during July and August and the body molt into the first winter plumage is continuous from August to October. The postjuvenal molt is complete except that the outer two pairs of primaries are retained a full year. Swarth (*in* Bent, 1932) noted that the first postnuptial or annual molt begins about the middle of July of the second year and lasts until about the middle of September.

The data on molt and weight presented here are based on the examination of 350 grouse on the breeding range at Quinsam Lake. Of this total 195 were chicks. The chicks were aged by dating the time when they were collected from the third week of June, the time of the peak in hatching. At least five birds were examined in each week between April and August in the years from 1950 to 1952. In September of 1950 and 1951 I examined for molt pattern and weight several hundred grouse taken by hunters.

MOLT IN CHICKS AND JUVENILES

The bird in natal or chick plumage is covered with a soft down and juvenal primary feathers are visible at the edges of the wings. By two weeks of age, seven pairs of primaries and at least twelve pairs of secondaries are present in each wing and in active growth. Juvenal contour feathers develop on the sides of the chest and juvenal rectrices appear on the tail. Flight is possible at this stage in plumage development.

At four weeks of age the seven juvenal primaries are almost completely grown and replacement from the wrist laterad is begun. Two more juvenal primaries appear distal to the original seven. By this time the twelve juvenal secondaries mature. Juvenal contour feathers sheath the top of the head, body, legs and wings. The sides and back of the head and upper neck are still in natal down. The juvenal rectrices are approximately one-half grown and the bird, except for the head, is in full juvenal plumage.

By six weeks of age the proximal or 1st juvenal primary is fully replaced while juvenal primaries 2, 3 and 4, in that order, are shed or being replaced. Juvenal primaries 8 and 9 are still in growth and juvenal primary 10 is visible. At this time, molt of the juvenal secondaries begins, usually mediad from the wrist. This molt pattern is irregular compared to that of the primaries. The juvenal rectrices are now approximately fully grown and replacement feathers are visible among them.

By eight weeks of age, juvenal primaries 5 and 6 are replaced by new feathers. Juvenal primary 8 is fully grown, 9 and 10 are one-half to fully grown. At this time replacement of the juvenal contour feathers begins on the shoulders and sides of the chest. The new rectrices are approximately one-half grown and extend beyond the juvenal rectrices still present.

By ten to twelve weeks of age juvenal primaries 7 and 8 are shed and the replacements are growing. The few remaining natal down feathers along with the juvenal contour feathers are, by now, almost fully replaced. By mid-September, or the age of 14

weeks, the new primaries (except the 8th), the secondaries, contour feathers and rectrices are approximately fully grown. It seems likely that all flight and contour feather development for the year is completed by October. This first fall plumage is carried until completion of a second fall molt and is called the yearling plumage. The yearling plumage results from a complete molt and replacement of chick and juvenal feathers with the exception of the two most lateral pairs of juvenal primaries, which are retained a full year.

In September, several differences may be noted between yearling and adult plumage (the plumage of birds going into at least their second fall season). At this time, the yearling plumage is lighter in color and more speckled with white. Yearling primaries 9 and 10 show this color difference as well as being more pointed than those of the adult bird. However, the most obvious difference between the two plumages is the shorter and narrower yearling rectrices. These are of characteristic size after all growth has ceased. Thus they can be used as an age criterion to separate yearlings from adults, which have the larger and wider rectrices gained in their second or later fall molt.

MOLT IN YEARLINGS AND ADULTS

The yearlings and adults begin in early summer what Swarth (*loc. cit.*) called the postnuptial molt. This molt is usually considered a complete replacement of plumage. The birds of two years and older are refeathered with apparently identical plumage while the yearlings assume the plumage of adult birds. There is some variation in this basic pattern.

Adults and yearlings of both sexes begin molting by the last week of May. At this time the 1st or innermost primary is replaced. By the end of June, primaries 2, 3 and 4 are either fully replaced or in the process of growth. At this time body molt begins in the head and neck and extends over the back, sides and legs. The brood patch of incubating hens is refeathered by the middle of July. By the end of July the 5th and 6th primaries are shed and being replaced while the new primaries are fully grown. Body molt continues with shedding and replacement of feathers. It is most noticeable in the cocks which show a white and black mottled appearance about the neck region. Concomitantly, the neck tissues of the male, swollen and deep yellow during April and May, become thin and pale in color. The same change is noted in the caruncle.

The samples obtained in August and mid-September indicate that primaries 7 and 8 are shed and in new growth at this time; this is true also in birds-of-the-year. Body molt continues. The first rectrix is shed by mid-August or late August; rectrices are replaced from the outside mediad. By mid-September most of the cocks and hens have a completely new set of tail feathers. The molt of the upper and lower tail coverts occurs simultaneously with the molt of the rectrices. Molt and feather replacement, as in the young, is probably completed by the end of October.

An unusual feature in this molt pattern is the rarity of molt of wing covert and secondary feathers. Of the adults and yearlings examined only two showed molt of the secondary feathers and this was erratic with the 3rd, 4th and 5th (counting mediad from the wrist) of the 12 secondaries being replaced in one, and the 2nd, 5th, 7th and 12th in the other. Both of these molts were observed early in August. If all feathers are to be annually replaced, then the secondary feathers, wing coverts and the 9th and 10th primaries, not molted by mid-September, must be shed later. However, complete annual molt may not always occur.

Two free-living adult males were dyed with red printer's ink dissolved in naphtha gas in May, 1952. They were shot and examined in early June, 1953. Any feather re-

placement in this time would be indicated by ink-free parts of the plumage. In both birds, the head, neck, body, tail and legs were uncolored. But the 10th primary was colored, as were all the secondaries except two. Most of the under and upper coverts of the wing were unmarked, although the first row of under coverts of the secondaries was solidly dyed. This evidence shows that a complete annual molt of the wing coverts and some of the primaries and secondaries does not always occur. A complete annual molt does occur in the head, body, leg and tail regions. If this condition is generally true of yearling Blue Grouse then age criteria based on the outer pair of primaries should be regarded with caution. A yearling bird which does not develop adult primaries in its second fall will still be classed as a yearling on the basis of characteristics of the primary feathers.

AGE CRITERIA FOR ADULTS

Van Rossem (1925) observed that Blue Grouse between their first and second fall molts (yearlings) have shorter and narrower rectrices than birds between their second and later fall molts (adults). Petrides (1942) measured the width of the outer rectrices of several Blue Grouse at a point one-half inch below the tip. Rectrices of the yearlings were three-quarters to seven-eighths of an inch in width. Rectrices of the adults were one and one-quarter to one and one-half inches in width. The length of tail was usually less than 6 inches in the yearlings and usually greater than 7 inches in the adults. Length of tail was subject to greater variation than width.

In this study the average length of the outer pair of rectrices separated the age classes better than average width. Moreover, length of rectrix was more easily and accurately obtained than width.

To establish age criteria based on this measurement, the outer pair of tail feathers of all birds examined other than juveniles were collected and measured for total length. Fully developed rectrices were used in measurements. The average lengths for each sex were then plotted in frequency diagrams, figure 1.

Birds of known first fall or yearling plumage were obtained at a British Columbia Game Department Road Check held in September at Campbell River, Vancouver Island. In September there are several ways of accurately identifying a bird-of-the-year other than by length of tail. The yearlings usually retain until this time a few juvenal feathers, as in the axillae. In yearling males the skin of the neck is not as colored or thickened or rugose as in adult males. In yearlings of both sexes the posterior edge of the sternum is not completely ossified and can be easily bent. Most characteristically, the bursa of Fabricius is a deep pouch 1 to 2 cm. in length in the yearlings whereas in the adults it is reduced in size or is absent. The hatched parts of figure 1 represent the birds in yearling plumage.

In addition to the yearling birds examined at the September road check a sample of unknown age of male and females was obtained from the breeding range in spring and summer at Quinsam Lake. The frequency of occurrence of average length of outer tail feathers in these birds is represented by the open columns or open parts of columns in the histograms.

Note in the figure for males that there is a clear break between birds with yearling rectrices and another class representing birds with adult rectrices. From the histogram it may be seen that yearling males have an average length of outer tail feathers ranging between 13.2 and 15.2 cm. Adult males have an average length of outer tail feathers ranging between 16.2 and 19.4 cm. In the females the break between age classes is not as clear cut; however, the two groups are evident. Hens can be classed as yearlings if

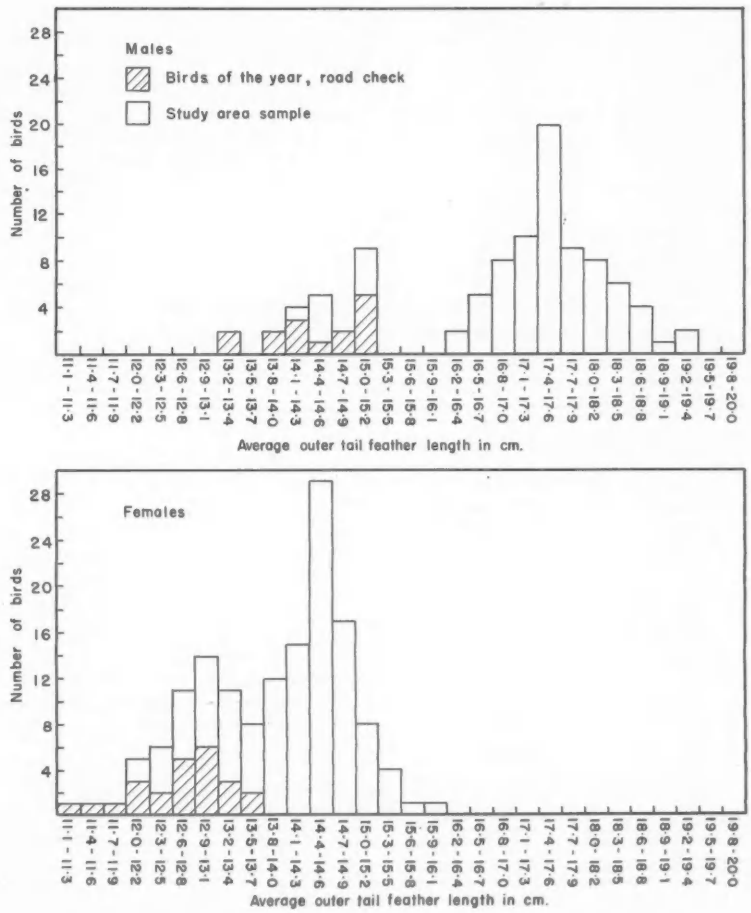

Fig. 1. Average lengths of outer tail feathers of yearling and adult Blue Grouse.

their average length of outer tail feathers falls between 11.1 cm. and 13.4 cm. and as adult hens if this length falls between 13.8 and 16.1 cm.

The bursa of Fabricius is an acknowledged indicator of age in many birds (Gower, 1939; Hochbaum, 1942; Kirkpatrick, 1944). Generally the bursa is resorbed within a year after hatching and is absent from most breeding birds. Buss and Schottelius (1954) recorded bursae of 1.8 cm. to 2.8 cm. in four Blue Grouse in adult plumage in October. They concluded that the birds were approximately one and one-half years of age and had not bred; it seems likely that the four birds were in their first adult plumage.

In this study, adult and yearling grouse of both sexes were examined on the breeding range for bursal depth. At this time the birds in yearling plumage are approximately

one year of age and the birds in adult plumage are at least two years of age. Territorial behavior was taken as an indication of a breeding male. In females the presence of a brood patch, well developed ova, or shed follicles were used as criteria for a breeding bird. Five yearling males had a modal bursal depth of 0.5 cm. with a range between 0.1 and 1 cm. None of the yearlings was a breeding bird. Twenty adult males had a modal bursal depth of 0.2 cm. with a range between 0 and 0.5 cm. Several males banded in previous years were examined. One was three years old, three were four or more years old, and one was five or more years of age. The three-year old male had a bursal depth of 0.2 cm., the rest were without bursae. All the adult males were breeding birds.

Eight yearling females had a modal bursal depth of 0.5 cm. with a range between 0.1 and 0.5 cm. At least three of these hens were breeding. In 19 adult hens examined, 16 were without a bursa whereas three had a bursa of 0.1 cm. At least 17 of these birds were breeding. In two banded hens of three or more years of age, one had a bursa of 0.1 cm.; the other was without a bursa.

These observations suggest that both male and female Blue Grouse retain a bursa into their second or third year. The presence of a bursa in males in adult plumage indicates a bird two or three years of age. If the bursa is absent the male is likely four or more years of age.

In most of the hens the resorption of the bursa appears to be completed in the second year of life. If it is present in an adult hen, this would suggest that the bird is two or three years of age. The relatively rapid resorption of the bursa in the hens is possibly related to age of breeding. None of the yearling males was breeding; however, at least three of the yearling hens were breeding birds. Since each of these hens had a measureable bursa, the presence of a bursa in yearling Blue Grouse cannot be used as an infallible indicator of a non-breeding bird.

It is curious that Buss and Schottelius recorded bursae of 1.8 to 2.8 cm. in birds of one and one-half years of age. This is the depth we and they recorded in four- to five-month old birds in the fall. In our sample of yearling males of approximately one year of age the bursa was not deeper than 1 cm. These observations suggest that the measurement of bursal depth is more subjective than indicated by the foregoing data and requires more rigorous definition.

SEX RATIO AND WEIGHT DEVELOPMENT OF THE YOUNG

Of 138 young collected at random in the period from June 15 to August 15 in 1951 and 1952, 70 were males and 68 were females. This deviation from an equal sex ratio is not statistically significant and supports a sex ratio of 100:100 in the young.

The weights of 224 young were obtained in this period and at the road-check station in September of 1950, 1951 and 1952. Birds collected or captured were weighed for total weight (crop contents excluded) and these weights, classified as to sex, were averaged for each week from the date of peak of hatching. The sample obtained from hunters provided weights of birds approximately 14 and 15 weeks of age.

The average weights and their confidence limits at the 95 per cent level for each sex are plotted against week of age in figure 2. After 8 weeks of age few data were available from the study area until grouse of 14 and 15 weeks of age were obtained from hunters. Between these ages the averages are likely to be unreliable. The relatively large road-check sample of 68 birds provides a good estimate of weight of birds of 14 and 15 weeks of age. At 14 weeks of age the males are significantly heavier than the females (5 per cent level used throughout). At 15 weeks of age the males have attained 885 ± 50 grams while the females are 725 ± 35 grams. Both weights are lower than those recorded for yearling males and females on the study area in spring and summer (see below).

If a best straight line is drawn through the points, its slope represents an average rate of weekly growth. In the males this is approximately 60 grams per week and in the females approximately 50 grams per week. These values are similar to the growth rates calculated for Blue Grouse young in Washington by Wing, Beer, and Tidyman (1944). They found growth rates to be 66 grams per week in males and 59 grams per week in females.

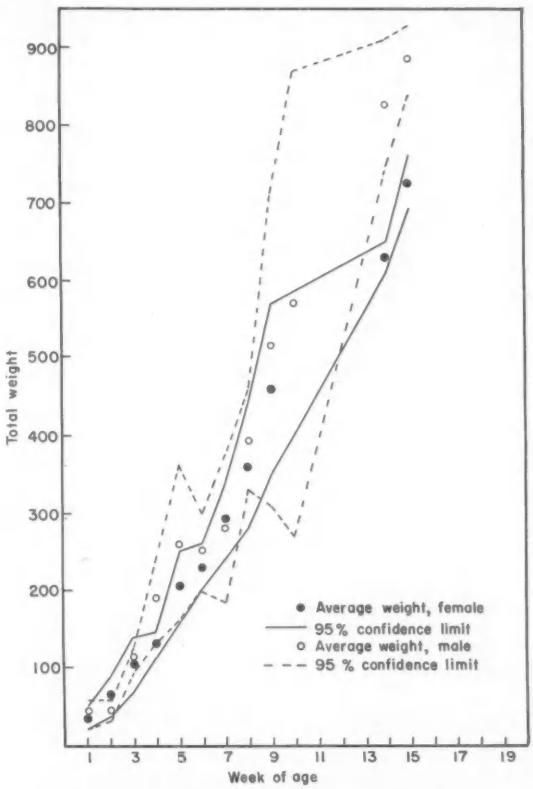

Fig. 2. Weight (grams) development of young Blue Grouse.

The greatest error in the calculation of growth rate and the description of plumage development results from the inability accurately to age the young other than from the date of peak of hatching. Thus, in pooling the weights of birds collected in any given week, variation in hatching date is ignored. This error contributes to the large fiducial interval observed in some samples. The use of weights obtained over three years of study is not considered a major source of error. A sample of 18 weights taken at the road check in 1951 was tested against a similar sample obtained on the same date in 1952. The difference between the two averages was not statistically significant. Moreover, assuming environmental effects were equal over the growth period of the two samples, this result would suggest little difference between 1951 and 1952 with respect to time of peak hatch.

WEIGHT OF YEARLINGS AND ADULTS

The average weights of adult males (crop contents excluded) captured or collected on the summer range in spring, summer and early fall are as follows:

Period weighed	Size of sample	Average weight and standard error of the mean
April, May	21	1285±30 gm.
June, July	34	1230±10 gm.
September	6	1245±50 gm.

The differences in the averages are not statistically significant.

The hens in late April and May are heavy with eggs and thus comparison with average summer weight is less meaningful. Of 24 recorded in this period the weights ranged between 850 grams and 1200 grams. A sample of 55 adult females obtained in June and July was 845±10 grams in average weight. A sample of 37 adult females taken in September was 850±10 grams in average weight. The difference between the two averages is not statistically significant.

These comparisons indicate no statistically significant change in the average weights of adult birds on the summer range. The samples from September give no indication of a weight gain prior or during migration to the winter range in the highlands. This, and the similarity of spring and early fall weights, would suggest conditions for weight development were comparable on the summer and winter ranges. Data on weight in the winter months and particularly in February and March, the time of spring migration, would be most instructive.

Eight yearling males weighed in May and June averaged 1110±40 grams. This is significantly lighter than the 1230±10 grams recorded for the adult cocks in June and July, and an indication that yearling males do not attain adult weight until after June in their second year.

Eleven yearling females weighed in June and July averaged 790±10 grams. This weight is significantly lighter than average weight of 845±10 grams recorded in the adult hens over the same period. It is likely that yearling hens do not attain adult weight until after July of their second year.

The use of pooled data from three years of study is not considered a major source of error in the calculation of average weight of adults. Where suitable samples were available in one year, these were tested in the same way as were the pooled data with similar results. The greatest error in the determination of adult weight results from the paucity of data. By pooling weights in one-month and two-month periods, short term fluctuations of weight are obscured, particularly when monthly samples are unequal in size.

ACKNOWLEDGEMENTS

This work was carried on under Dr. J. R. Adams and Dr. I. McT. Cowan in the Department of Zoology of the University of British Columbia. The National Research Council of Canada and the Research Council of Ontario provided financial assistance. Fellow students and Game Officers were most cooperative at road-check stations set up by the British Columbia Game Department.

SUMMARY

Observations on age groups of Blue Grouse on Vancouver Island, British Columbia, are presented. By October, chicks of the first year are in plumage similar to the adults with the exception of shorter and narrower rectrices. The chick, postjuvenal and annual

molt follows a recognizable pattern of replacement of flight and contour feathers. There is evidence that the annual molt of flight feathers is not complete in adult birds.

Several criteria of age are defined. The average length of the outer pair of rectrices in yearlings (birds between their first and second falls) ranges between 13.2 and 15.2 cm. in males and probably between 11.1 and 13.4 cm. in females. The same measurement in adults (birds between their second and later falls) ranges between 16.2 and 19.4 cm. in males and probably between 13.8 and 16.1 cm. in females.

The presence of the bursa of Fabricius in a Blue Grouse in adult plumage indicates a bird of two to three years of age. Its absence from males in adult plumage indicates a bird of four years of age and older.

A sample of 138 young collected in the period from June 15 to August 15 in 1951 and 1952 was 100:100 in sex ratio.

Over the period from June 15 to September 23 (1 to 15 weeks of age) the average growth rate of young males and females is approximately 60 and 50 grams per week, respectively.

The average weights of adult birds on the summer range showed no statistically significant change between April and September. In June and July adult males averaged 1230±10 grams; adult females, 845±10 grams.

Eight yearling males and 11 yearling females weighed in May, June, and July averaged 1110±40 grams and 790±10 grams, respectively, an indication that yearlings do not attain adult weight until after June or July of their second year.

LITERATURE CITED

Bent, A. C.
1932. Life histories of North American birds. U. S. Nat. Mus., Bull. 162:103–114.

Buss, I. O., and Schottelius, B. A.
1954. Breeding age of blue grouse. Jour. Wildl. Mgt., 18:137–138.

Gower, W. C.
1939. The use of the bursa of Fabricius as an indication of age in game birds. Trans. N. Amer. Wildl. Conf., 4:426–430.

Hochbaum, H. A.
1942. Sex and age determination of waterfowl by cloacal examination. Trans. N. Amer. Wildl. Conf., 7:299–307.

Kirkpatrick, C. M.
1944. The bursa of Fabricius in ring-necked pheasants. Jour. Wildl. Mgt., 8:118–129.

Petrides, G. A.
1942. Age determination in American gallinaceous game birds. Trans. N. Amer. Wildl. Conf., 7:308–328.

van Rossem, A. J.
1925. Flight feathers as age indicators in *Dendragapus*. Ibis, 1925:417–422.

Wing, L., Beer, J., and Tidyman, W.
1944. Brood habits and growth of "blue grouse." Auk, 61:426–440.

Department of Biology, Queen's University, Kingston, Ontario, March 24, 1955.

NOCTURNAL DECLINE IN THE TEMPERATURE OF BIRDS IN COLD WEATHER

By LAURENCE IRVING

In temperate climates many birds show a departure from strict homoiothermism in the decline of their body temperature during sleep. In order to determine whether this modification of body temperature is related to climate, I have recorded temperatures of 13 individuals of seven species of birds captured in Alaska and examined on five occasions during cold winter weather at Anchorage. I am indebted to Mrs. Mildred Monson, Mr. John Krog and Dr. Raymond Hock for their help with the measurements.

The temperature of the birds was examined at various hours during January, February and March by insertion of thermocouples through the cloaca. The couples reached deep enough into the birds' bodies to indicate the temperature of central tissues. When the cages were approached at night, the alert gulls raised a commotion and none of the birds remained undisturbed when approached. We did not catch a bird while asleep nor did we find them drowsy. The strong, vicious gulls and Snowy Owls were grasped quickly and all birds were examined before their activity exceeded the state which by day we have called resting but awake.

The following birds were examined: Black Brant, *Branta bernicla* (caught near Hooper Bay, migrates to a warm winter climate); Emperor Goose, *Philacte canagica* (caught near Hooper Bay, migrates to maritime situations with temperature little below freezing); Glaucous-winged Gull, *Larus glaucescens* (caught near Seward, migrates to shores of ice-free waters); Glaucous Gull, *Larus hyperboreus* (caught near Hooper Bay, winters near any open water, even in arctic Alaska); Snowy Owl, *Nyctea scandiaca* (caught near Barrow, where they reside winter and summer); Short-eared Owl, *Asio flammeus* (caught near Barrow, from which it migrates in autumn to mild temperate climates); and Magpie, *Pica pica* (caught near Anchorage, resident through interior subarctic Alaska).

Body temperature at Anchorage by day and night.—The temperatures in the birds' bodies showed no relation to the temperature of the air (table 1). When plotted against hour of the day, the body temperatures at night were lower than by day except for one record of the Glaucous Gull which was as warm at midnight as at midday. Since at 5 a.m. this bird was 2.5°C. cooler than by day, we consider its high temperature at midnight the result of excitement on that occasion.

Stability of the resting body temperature.—The average of daytime resting body temperature differed only a little from the averages earlier reported for those species (table 2). In the measurements of resting body temperature which we have made among birds and mammals in Alaska (Irving and Krog, 1954), the records obtained from numerous individuals of a species could usually be included in a span of about 2°C. Because many measurements were made in the field in arctic winter weather, errors easily add to the appearance of variation in the temperature of individuals. Furthermore, the state of rest in animals is defined by arbitrary judgment of the observer. In setting the variability of the resting body temperature of individuals of arctic species of birds and mammals, we have had to include errors in measurements and estimates of activity. The true natural differences of the resting body temperature of individuals of a species are probably less than the records indicate.

Nocturnal decline in body temperature of birds.—By night the body temperature of birds in temperate regions subsides, as Wetmore (1921) showed in his review of the earlier literature and as has been often recorded subsequently. Udvardy's (1953) rec-

Table 1

Depression of Body Temperature of Birds at Night in Cold Weather
(Depression = mean of day temperatures — coldest observed at night)

	Hour					
	Temperature, degrees centigrade					Depression of body temperature
	5 a.m.	9:30 a.m.	1 p.m.	9 p.m.	12 p.m.	
Air	—20.0	—23.0	— 9.0	—22.0	—16.0	
Black Brant	41.7	41.8	42.7	41.2	41.0	1.3
Emperor Goose	41.7	42.2	42.5	41.0	41.0	2.2
Glaucous Gull	40.2	42.6	42.5	40.0	42.3	2.5
Glaucous-winged Gull	40.4	41.5	42.1	41.2	38.2	4.0
	41.1	42.1	42.2	41.4	38.6	
	41.6	42.1	42.5	41.7	40.6	
		42.1	42.7		41.6	
Snowy Owl	40.2	40.6	41.5	40.2	40.0	0.9
Short-eared Owl	38.8	39.2	42.0	39.9	39.5	2.2
	39.2	39.7	42.2	40.0	39.7	
	39.8	40.6	42.3	40.0	40.1	
	40.3			40.5	40.7	
	40.7				40.7	
Magpie		42.5	42.2	41.0	40.0	2.4

ords of recently captured birds in the laboratory in Sweden show examples of body temperatures declining during sleep and rising when awakening. In the warm climate of southern California, Dawson (1954) showed nocturnal depressions of temperature amounting to nearly 3°C. in Abert and Brown towhees (*Pipilo aberti* and *Pipilo fuscus*). His records with thermocouples implanted in the breast musculature show the steadiness and distinction of the night and day temperature levels.

The measurements at Anchorage were made at times of cold weather. The resting body temperatures of the birds by day conformed with earlier measurements and bore no relation to the temperature of the air. The lowest temperatures observed at night in the several species were from 0.9°C. to 4.0°C. cooler than the average temperatures during the day. These are of the order of the night depressions observed among birds in temperate regions and there is no indication that the variation between night and day temperatures is related to life in the cold winter climates of Anchorage.

The decline of body temperature at night is not obligatory upon birds in all climates, for Bartholomew and Dawson (1954) and Dawson (1954) found that during experimental exposure at 39°C. their birds failed to cool off as much at night as in cooler air. Apparently in birds body temperature may remain above customary levels by night or by day when hot weather requires all means to be used for the dissipation of heat.

Table 2

Resting Body Temperatures of Birds

	Irving and Krog, 1954		Present Series	
	Number of records	°C. records	Number of records	°C. records
Glaucous Gull	3	42.1	2	42.2
Glaucous-winged Gull	11	41.7	8	42.2
Snowy Owl	4	40.9	2	40.9
Short-eared Owl	13	41.2	6	41.0
Magpie	3	41.5	2	42.2

Diurnal rhythm of activity among arctic owls.—As I have seen them on the tundra in arctic Alaska, Snowy and Short-eared owls are active by day in summer. In winter, I have only seen Snowy Owls by daylight, when they are certainly active. In the wooded parts of arctic Alaska in summer, I have frequently seen Horned and Hawk owls active during the day. In spring and autumn the activity of Horned Owls extends into twilight later than does the activity of common diurnal birds. The captive owls, when undisturbed, were still at night and awake by day, and their temperatures ranged about as would be expected among birds which rest at night in lower latitudes. None of our birds was noticeably easier to catch at night than by day. Although most of them were distinctly cooler at night, we did not notice them to be drowsy at the depressed nocturnal temperatures.

Elevation of body temperature during activity.—We have found that wild birds killed instantly during vigorous exertion, or captive large mammals which could continue violent struggles against restraint, were sometimes 2°C. warmer than their average temperature when at rest (Irving and Krog, 1954). Wetmore (1921) remarked upon the warming of birds in a temperate climate during their vigorous exertion. The average temperatures in small petrels (*Pachyptila turtur*) returning from fishing at sea to their nesting place on an island off New Zealand was on the average 41.5°C.; when these birds were active about their nesting burrows it was 39.9°C., and when incubating, 38.6°C. (Farner, 1955). In Sweden, Udvardy (1953) showed elevations of body temperature in active birds and declines during rest after activity. These birds were comparable with ours in being species of a northern avifauna but their body temperature was not examined in relation to cold weather.

Probably the warming of active birds is comparable to that which occurs in active man, for whom the highest temperature that I have seen reported was 4°C. above the resting level in champion distance runners after a long race (Robinson, 1953). Marius Nielsen (1939) has shown that the elevation of human body temperature by activity is related to the rate of working and unrelated to variation in the temperature of the air.

Discussion.—In sleep the body temperature of man declines (Deighton, 1933) although not as much as is commonly seen among birds. In each species of warm-blooded animals there is apparently a level of body temperature which is maintained during sleep and another which is held in a wakeful state of rest, but during activity the temperature rises toward some limit set by the animal's metabolism.

Among birds the normal range in temperature from sleep to waking activity is, according to the figures quoted, some 6°C. It may be even greater in some species, and the thirsty camel in the Sahara may warm from 34°C. in the cool desert night to 41°C. during a hot day. These variations in body temperature occur normally, although with specific differences, in birds and mammals possessing effective regulation of their heat balance. It is interesting to consider these examples indicating that homoiothermous animals normally effect regulated changes in body temperature which are so large that they would be considered dangerous symptoms if they were observed during fever or as a result of exposure to cold.

SUMMARY

The body temperature in seven species of birds captured in Alaska and held in captivity at Anchorage was examined at various times of day. In winter air temperatures between −9°C. and −22°C., the body temperatures by day were about those reported for these species on warmer days. At night they were from 0.9°C. to 4°C. lower. The night-time decline in body temperature was similar to that reported to occur in tem-

perate climates. Considering that activity can elevate body temperature some 3°C. above that at rest, it is apparent that homoiothermous animals change body temperature in sleep, waking rest, and activity in cold as in temperate weather.

LITERATURE CITED

Bartholomew, G. A., Jr., and Dawson, W. R.
1954. Body temperature and water requirements in the mourning dove *Zenaidura macroura marginella*. Ecol., 35:181–187.

Dawson, W. R.
1954. Temperature regulation and water requirements of the brown and Abert towhees, *Pipilo fuscus* and *Pipilo aberti*. Univ. Calif. Publ. Zool., 59:81–124.

Deighton, T.
1933. Physical factors in body temperature maintenance and heat elimination. Physiological Rev., 13:427–465.

Farner, D. S.
1955. Difference in body temperature in flight and at rest in the fairy prion (*Pachyptila turtur*). Federation Proceedings, 14:46.

Irving, L., and Krog, J.
1954. Body temperature of arctic and subarctic birds and mammals. J. Appl. Physiol., 6:667–680.

Nielsen, M.
1938. Die Regulation der Körpertemperatur bei Muskelarbeit. Skandinav. Archiv. f. Physiol., 89:193–230.

Robinson, S.
1953. Applications of physiology in athletics. National Collegiate Track Coaches Association Notes, June, 1953, 4 pp.

Udvardy, M. D. F.
1953. Contributions to the knowledge of the body temperature of birds. Zoologiska Bidrag fran Uppsala, 30:25–42.

Wetmore, A.
1921. A study of the body temperature of birds. Smithsonian Misc. Coll., vol. 72, no. 12, pp.1–52.

Arctic Health Research Center, United States Public Health Service, Anchorage, Alaska, June 28, 1955.

NORTH AMERICAN SHORE BIRDS IN SURINAM

By F. HAVERSCHMIDT

Along the coast of Surinam vast tidal mud flats, shallow brackish lagoons, rivers, and creeks provide habitat for large numbers of migrating or wintering shore birds which breed in North America. The records herein reported are the result of nine years of work in many places along the coast, but mainly in the western part of the country from the mouth of the Corentyne River east to the mouth of the Surinam River, including the coast near Nickerie, the lagoons east of Nickerie, the coast near Coronie, and the mouth of the Coppename River. Farther to the east I also visited the lagoons near Matapica Creek, Commewijne District, which, unlike the natural lagoons east of Nickerie, are flooded and deserted cotton plantations. I visited these places in all months of the year, and for nearly all the common shore birds I was able to determine that many non-breeding individuals spend the northern summer along our coast.

Readers may be interested to learn that in Surinam shore birds are comparatively little disturbed by hunters, who, in general, are interested in large game. Occasionally a hunter will shoot into a compact flock of the larger species of shore birds, but wholesale killing or even regular hunting, as seems to be practiced in neighboring French Guiana, does not occur in Surinam. The game law of Surinam prohibits hunting of all shore birds except the Hudsonian Curlew, which may be taken in the period from October 1 to April 1.

In the following list only those species which I have personally observed and collected are included. If not otherwise indicated all specimens are preserved in the Leiden Museum. I have omitted the Black-necked Stilt (*Himantopus himantopus*), which at times is extremely common on shallow lagoons near the coast, as it is possible that individuals occurring in Surinam during the northern winter are members of the local breeding population rather than migrants from North America. According to James Greenway (in *litt.*), there is a specimen of the Stilt Sandpiper (*Micropalama himantopus*) from Surinam in the Museum of Comparative Zoology; I have never recorded this species. Nor have I any records of godwits (*Limosa*), oystercatchers (*Haematopus*), or Baird Sandpiper (*Erolia bairdii*).

Squatarola squatarola. Black-bellied Plover. Rather common on coastal mudflats and along outer rivers. The largest flock recorded consisted of about 50 birds noted at the coast near Coronie on September 12, 1946. Northern summer records: 2 on coast near Nickerie, June 15, 1953; 2 on coast near Coronie, July 13, 1953. All summering birds were in winter plumage. On November 17, 1953, I collected a bird that was still in nearly full breeding plumage on the coast near Nickerie.

Pluvialis dominica. Golden Plover. Apparently rare, as I have only two records: 3 near a lagoon at Coronie, September 12, 1946; and about 10 at the same locality, September 13, 1946.

Charadrius hiaticula semipalmatus. Semipalmated Plover. One of the commoner shore birds on coastal mudflats and along outer rivers. Present throughout the year; many individuals spend the northern summer along the coast; many at mouth of Coppename River, June 5 and 6, 1948; 12 near Nickerie, June 15, 1953; about 100 near Coronie, June 18, 1954 (specimen); numerous at mouth of Coppename River, July 10 and 11, 1947. Also occurs inland; a single individual was recorded at Republiek, about 55 kilometers from the coast, on September 30, 1948 (specimen).

Charadrius wilsonia wilsonia. Wilson Plover. On December 1 and 2, 1952, there were a great many *C. wilsonia* in a large flock of *Ereunetes pusillus* and *Charadrius hiaticula* on a sandbank isolated by a high tide on the coast near Coronie. I collected 3 specimens which were identified as *C. w. wilsonia* by Dr. Junge of the Leiden Museum. This apparently is the first record of the northern race in Surinam; but its occurrence was to be expected, as Lincoln (Migration of North American Birds, 1935) mentioned the recovery in British Guiana of a bird banded in the United States. The

resident race of this plover, *C. w. cinnamominus,* cannot be distinguished in the field from the nominate race. Both are confined to sandy beaches.

Bartramia longicauda. Upland Plover. My records are as follows: one collected from flock of 4 near Paramaribo, March 26, 1947; one at same locality, December 26, 1949; one on dry savanna near Zanderij, about 50 kilometers south of Paramaribo, January 1, 1950. Bangs and Penard (Bull. Mus. Comp. Zool., 62, 1918:44) mentioned a bird collected near Paramaribo in April. The fact that this species frequents rather dry ground inland may account for its apparent rarity in Surinam.

Numenius phaeopus. Hudsonian Curlew. Regular and quite common on coastal mudflats and along outer rivers. Present throughout the year; a few spend the northern summer along the coast; few at mouth of Coppename River, June 5 and 6, 1948; few at mouth of Corentyne River, June 13, 1953; few near Nickerie, June 9, 1954; 6 near Coronie, June 18, 1954; 2 at same locality, July 9, 1946. Arrival of wintering birds from the north begins at the end of July; on July 30, 1954, there were about 50 on the coast near Coronie.

Tringa flavipes. Lesser Yellow-legs. Very common on coastal mudflats and shallow lagoons inland from the coast line. Recorded throughout the year; quite a number remain through the northern summer: several flocks at mouth of Coppename River, June 5 and 6, 1948; flock of 38 in rice field on the "Peperpot" plantation along the right bank of the Surinam River, June 9, 1949 (specimen); several at mouth of Coppename River, July 10 and 11, 1947; few near Coronie, July 13, 1953.

Arrival of wintering birds from the north seems to begin at the end of July, as I noted a flock of about 250 near Nickerie on July 31, 1947, and about 200 birds at the mouth of the Corentyne River on August 1, 1947. In areas of favorable habitat large numbers may be assembled. Thousands were present on very shallow lagoons near Nickerie on December 20 and 21, 1946, and near the Matapica Creek, Commewijne District, on November 30, 1947. *T. flavipes* also occurs far inland, as I collected a specimen at Republiek, about 55 kilometers from the coast, on September 9, 1948.

Tringa melanoleuca. Greater Yellow-legs. Numerous on coastal mudflats and lagoons, occurring in smaller flocks than *T. flavipes.* Recorded throughout the year. Northern summer records: few at mouth of Coppename River, June 5 and 6, 1948; 3 at Nickerie, June 15, 1953, and 3 at Coronie, on July 10, 1946, and few on July 13, 1953; 2 near Leonsberg, Surinam River, on July 6, 1953.

This species is more common inland than *T. flavipes.* I collected specimens at Zanderij, about 60 kilometers from the coast, on October 9, 1947, December 4, 1949, February 5, 1950, and September 2, 1951.

Tringa solitaria. Solitary Sandpiper. Quite common, frequenting fresh-water marshes, shallow ditches, creeks, and temporary pools; avoids coastal mudflats. Apparently no individuals of this species spend the northern summer in Surinam, as there are no June records. My earliest date of its arrival from the north is July 22, 1951, when I noted a single bird at a ditch near Paramaribo. By the end of July this species is common; several were present in a swamp near the Corentyne River on July 31, 1953. My latest spring record is of a few at the same locality on May 4, 1947.

Actitis macularia. Spotted Sandpiper. Very common, lone individuals occurring on coastal mudflats, along rivers from the coast far inland, along ditches and creeks, and at temporary pools on roads; never seen in flocks. Arrival of birds from the north begins early in July. Two individuals were recorded at Leonsberg on July 6, 1953, where none was recorded during the previous month. On July 10 and 11, 1947, several were noted at the mouth of the Coppename River. By the end of July the species is quite common; many were seen near Nickerie on July 24, 1946, and all along the Cottica River on July 29, 1946. Wintering birds remain in Surinam until the latter part of May and, rarely, the first part of June. The species was recorded at Paramaribo on May 18, 1948; 2 were seen at the Saramacca River on May 24, 1953, and 3 were present at Nickerie on May 23, 1954. Although I have been constantly on the watch for this species in June, I have recorded it only once, on June 9, 1954, when two birds in full breeding plumage were found near Nickerie. One of these proved to be a male with enlarged testes, suggesting that it is a late migrant rather than a summering bird.

The first migrants from the north arrive in Surinam in breeding plumage. Transition to winter plumage begins at the end of August, as indicated by a few birds in mixed plumage near Nickerie on August 22, 1954. The breeding plumage begins to appear in the last part of March; 2 birds in full breeding plumage were recorded at Leonsberg on March 23, 1955 (specimen), and on March 25, 1955, one in breeding and one in winter plumage were noted near Coronie.

Catoptrophorus semipalmatus. Willet. Common but confined to tidal mudflats and outer rivers.

Many remain through the northern summer: several at mouth of Coppename River, June 5 and 6, 1948, and July 10 and 11, 1947; few at Coronie, June 18, 1954; several at Saramacca River, July 12, 1946. Arrival from the north seems to begin at the end of July; hundreds were present on the coast near Coronie on July 30, 1954.

Arenaria interpres morinella. Ruddy Turnstone. One of the commoner shorebirds on tidal mudflats and along outer rivers. Recorded throughout the year; many remain through the northern summer: several at mouth of Coppename River, June 5 and 6, 1948; 12 at Nickerie, June 9, 1954; about 30 at same locality, June 15, 1953; 12 at Coronie, June 18, 1954 (specimen); several at mouth of Coppename River, July 10 and 11, 1947; small flock at Coronie, July 13 and 14, 1953. Birds which summer in Surinam generally do not assume breeding plumage, but on June 15, 1953, a single individual in full breeding plumage was seen among a flock of about 30 at Nickerie.

At high tides these birds frequently rest in long rows on the branches of mangroves, often several feet above the water, and also on stakes put into the water by fishermen.

Limnodromus griseus griseus. Short-billed Dowitcher. A very locally distributed species which I have found numerous only on the vast tidal mudflats at the mouth of Coppename River. Here great numbers were assembled on June 5 and 6, 1948, July 10 and 11, 1947, and April 1, 1953 (specimen). On the last date some birds were partially in breeding plumage. A few were present at a shallow lagoon near Coronie on September 13, 1946 (specimen).

Calidris canutus. Knot. A rare bird which I have recorded only twice: compact flock at the coast near Nickerie, August 23, 1953; single individual in breeding plumage at same locality, May 23, 1954.

Crocethia alba. Sanderling. Uncommon singly or in groups of two or three on sandy beaches along the coast. Recorded throughout the year. Northern summer records: Nickerie, June 14, 1953; Coronie, June 18, and July 30, 1954.

Ereunetes pusillus. Semipalmated Sandpiper. The commonest small sandpiper on tidal mudflats and along outer rivers; never seen inland. Many remain through the northern summer: numerous at mouth of Coppename River, June 5 and 6, 1948; small flock near Coronie, June 18, 1954 (specimen), and few at same locality, July 14, 1953.

Ereunetes mauri. Western Sandpiper. On December 1, 1952, a very large flock of *Ereunetes pusillus*, mixed with large numbers of *Charadrius hiaticula* and *Charadrius wilsonia*, was concentrated by a high tide on a sandbank at the coast near Coronie. Among a number of birds collected at that time was a single specimen of *Ereunetes mauri* (specimen in American Museum of Natural History). This appears to be a considerable extension of known winter range. According to Peters (Check-List of Birds of the World, 2, 1934:283), *E. mauri* has not been recorded farther east in South America than Venezuela.

Erolia minutilla. Least Sandpiper. Much less numerous than *E. pusillus* and, in contrast to that species, not found on tidal mudflats, occurring only on shallow lagoons and far inland. Because this species is difficult to distinguish in the field from *E. pusillus*, all my records are based on specimens, as follows: Nickerie, April 20, 1953; Republiek, October 12, 1947; Zanderij, October 23, 1949; Matapica Creek, October 26, 1954; Leonsberg, November 6, 1953.

Erolia fuscicollis. White-rumped Sandpiper. Two records, both inland: Coronie, September 21, 1946 (specimen); Republiek, November 2, 1947 (specimen).

Erolia melanotos. Pectoral Sandpiper. Two records, both inland: Republiek, September 30, 1948 (specimen), and October 12, 1947 (specimen).

Summary.—Many northern shore birds winter along the coast of Surinam, and small numbers of the following species also remain through the northern summer: *Squatarola squatarola, Charadrius hiaticula, Numenius phaeopus, Tringa flavipes, Tringa melanoleuca, Catoptrophorus semipalmatus, Arenaria interpres, Limnodromus griseus, Crocethia alba*, and *Ereunetes pusillus*. As a rule, summering individuals are in immature or in winter plumage.

Charadrius hiaticula, Tringa flavipes, and *Tringa melanoleuca* occur inland on shallow lagoons as well as on tidal mudflats along the coast. *Erolia minutilla, Erolia fuscicollis, Erolia melanotos*, and *Tringa solitaria* seem to be confined to inland habitats.

Ereunetes mauri is recorded for the first time from Surinam.

Paramaribo, Surinam, April 5, 1955.

The Great Crowned Pigeon (*Goura cristata*) of New Guinea, adult and nestling, in the collections of the Zoological Society of San Diego.

This spectacular pigeon is the largest of the species in the family Columbidae. Its coloration is blue-gray, except for a chestnut mantle and white wing-patch. The juvenile is similar. The photograph shows a nestling 24 days old. In this first nesting of the species at the San Diego Zoo, the one egg laid was incubated for 28 days, and incubation proceeded as in other pigeons, with both sexes sharing care and relieving each other twice a day. The photograph, taken on August 5, 1954, was contributed by Kenton C. Lint, Curator of Birds at the San Diego Zoo.

FROM FIELD AND STUDY

Cyanide Poisoning of Songbirds by Almonds.—On February 15, 1955, a call was received by the California Deparment of Fish and Game reporting that hundreds of birds were dead in a residence area in the Sacramento Valley. Ernest Clark investigated the locality that afternoon and picked up about fifty birds and a sample of the almonds on which they were feeding. The property is located in Citrus Heights, about fifteen miles east of Sacramento, and was an old almond orchard which had been built up to homes. However, many of the almond trees remain. Several hard shell almond trees (*Prunus amygdalis*) were on the property and unharvested almonds were on the lawn as well as in the trees. All the dead birds proved to be American Goldfinches (*Spinus tristis*), although Scrub Jays (*Aphelocoma coerulescens*) were also feeding on the nuts.

Mr. Clark checked the area again on February 16 and picked up birds. These were brought in and examined by the Department's Disease Laboratory in Berkeley, with negative results. On February 18, Macgregor checked the area and observed approximately fifty American Goldfinches feeding on the almonds. One male, while feeding on the lawn, went into convulsions and somersaulted over and over for about ten seconds, then spread his wings out in a final spasm and died. A few minutes later another male dropped from one of the trees onto the lawn. This bird was immobile, but his heart kept beating for three minutes before stopping.

Assistance and advice were sought from Dr. Stuart A. Peoples of the University of California at Davis. Dr. Peoples' analysis of several of the partly eaten almonds showed that they had a cyanide content of approximately 0.2 milligrams per nut. He suggested that we take some amylnitrite and administer it to some of the birds just after they fell. This was done by placing a drop or two on a cloth and holding it next to the nostrils of the stricken bird for about twenty seconds. The effect of this was spectacular, for when so treated, the apparently lifeless bird came to, shook its head, and after about three minutes regained its equilibrium and was able to fly again.

One bird so treated was held for observation. It vomited bits of almond but was in good condition for 24 hours. It died the following afternoon, but this probably was due to conditions of captivity rather than the poison. The amylnitrite is a specific antidote for cyanide poison and reacts with the cyanide, neutralizing it so that it can be removed from the system.

Auld in 1908 (Jour. Chem. Soc. (London) Trans., 93:1251–1280) has shown that amygdalin and an emulsion are coexistent in the seeds of almonds and when water is added the emulsion hydrolyzes the amygdalin, forming benzaldehyde, hydrocyanic acid, and dextrose: $C_{20}H_{27}ON + 2\ H_2O \rightarrow C_6H_5CHO + HCN + 2\ C_6H_{12}O_6$. This is evidently the reaction which took place at the Citrus Heights location. This is an unusual situation because normally the nuts would have been harvested and not available to the birds.

Ross Waggoner of the Department investigated a situation at an almond shelling plant near Yuba City, California. He reported that 3000–5000 dead birds, mostly goldfinches and some House Finches (*Carpodacus mexicanus*), were found in the vicinity of a pile of almond shells. These almond shells had been there all winter, but recently the top layer of almonds had been removed, thus exposing unweathered shells. Small bits of almond meat adhered to the shells and the birds were feeding on this almond meat. A rain occurred on February 14, and this evidently provided the water for the hydrolysis. Almost all of the birds died during a 48-hour period following the rain.

In all the years this plant has been in operation this is the first time there has been an incident of this nature. Although no analysis of the nuts was made, it seems probable that the birds were being poisoned by hydrocyanic acid in the same way as those at Citrus Heights.—Wallace G. Macgregor, *California State Department of Fish and Game, Sacramento, California, March 28, 1955.*

The Rufescent Mourner in Chiapas, Mexico.—The Rufescent Mourner (*Laniocera rufescens*) apparently has not been found heretofore north of Guatemala. During late April of 1955 while collecting in the jungles known as El Ocote, some fifty kilometers northwest of the town of Ocozocoautla, Chiapas, I collected four specimens of this species at an altitude of 2000 feet. At this locality I found

that the species is not at all rare. The bird lives at medium heights in the rain forest and at this season its very conspicuous whistle call can be heard all morning. Its behavior and general aspect is that of the Thrush-like Manakin (*Schiffornis turdinus*) excepting for its color. In the field this bird may be confused with the Rufous Mourner (*Rhytipterna holerythra*) which also lives in the same habitat.—MIGUEL ALVAREZ DEL TORO, *Instituto Zoologico del Estado, Tuxtla Gutierrez, Chiapas, México, August 10, 1955.*

A Supposed Record of a Fossil Cormorant.—Shufeldt (Auk, 32, 1915:485–488, pl. 30) described in considerable detail a fragment of fossil bone from the Miocene of the Arikaree Sandstone, collected in southeastern Montana, and identified the specimen as *Phalacrocorax macropus* (Cope). This record has been carried in the two editions of the check-list of the fossil birds of North America that have appeared since, but with definite uncertainty, since *P. macropus* otherwise is known only from the Pleistocene deposits of Fossil Lake, Oregon. Although the specimen has been in the collections of the United States National Museum (Div. Vert. Paleo. cat. no. 3251), it has not been expedient to check the identification until recently. Careful examination indicates that while the bone is avian, and superficially suggests a cormorant, it is so crushed that there can be no certainty as to its allocation; there is even doubt as to the family to which it belongs. The record therefore is one that must be dropped from our list. Shufeldt's illustration (fig. 2) shows clearly the form and condition of the specimen.—ALEXANDER WETMORE, *Smithsonian Institution, Washington, D.C., July 14, 1955.*

Hermit Warbler at Roswell, New Mexico.—On the morning of May 8, 1955, I observed a lone Hermit Warbler (*Dendroica occidentalis*) at Roswell, New Mexico, which I tentatively identified as a female. I returned later that day to the site of observation and took the bird for a record specimen. The skin was sent to the United States Fish and Wildlife Service, where J. W. Aldrich reported that as far as known the only other definite previous records for the Hermit Warbler for the state are a female specimen in the United States National Museum, taken on August 3, 1908, at 8000 feet on Animas Peak, and two specimens in the Peet collection at the University of Michigan Museum of Zoology, taken on September 13 and 19, 1927, at Reserve. Both places are near the Arizona line and approximately 200 air miles west of Roswell, which is in the Pecos Valley.—VESTER MONTGOMERY, *Roswell, New Mexico, August 17, 1955.*

Notes on Food Habits of the White-tailed Kite in Southern California.—Since 1951 a pair of White-tailed Kites (*Elanus leucurus*) has been under observation by the writer in the area along Ballona Creek, 2 miles northeast of the Pacific Ocean, Los Angeles County, California. Recently vandals have shot one of the pair. Fearing that the other bird might also be shot and no longer available for study, the writer collected a number of pellets and loose skeletal material from beneath the bird's roost in a dead tree. The vegetation surrounding the roost is largely *Salicornia ambigua.*

The average size of 9 pellets, which had not been loosened by recent rains, was 33×17×15 mm. While the possibility exists that some of the material examined represents food eaten by another species of predatory bird, repeated observations have shown the White-tailed Kites to be the only raptorial species using this roost. Following is a tabulation of the contents of the pellets.

Species	Number of specimens	Per cent of total
Mus musculus	15	53.8
Microtus californicus	4	15.3
Reithrodontomys megalotis	3	11.5
Thomomys bottae	1	3.9
Sylvilagus sp.	1	3.9
Sorex ornatus	1	3.9
Peromyscus sp.	1	3.9
Bird (unidentified passerine)	1	3.9

Although most investigators have reported high percentages of *Microtus* in the diet of the White-tailed Kite (Bond, Condor, 42, 1940:168; Hawbecker, Condor, 42, 1940:106–111, and 44, 1942:267–276), in another section of Los Angeles County, Bond (Condor, 44, 1942:231–232) similarly found that the kites were feeding largely on *Mus.*—JOHN D. CUNNINGHAM, *Department of Zoology, University of California, Los Angeles, California, February 18, 1955.*

Killdeer Fails to Desert Displaced Nest.—On July 16, 1955, my son was harrowing a dry hillside at Escondido, California, that had previously been cultivated every few weeks. A pair of Killdeers (*Charadrius vociferus*) followed him and showed distress whenever the tractor approached a certain place. At length the tractor passed over the "nest" and the teeth of the harrow buried three of the four eggs before they were seen. The tractor was stopped and the driver dismounted, picked up the visible egg and felt through the soil to find three more. These he placed "about 12 feet uphill from where the eggs had been," on a small spot which he flattened with his hand. The parents ran around in circles, finally locating the eggs, and immediately one bird sat on them. Four days later the parents were still incubating. Apparently the members of the pair take turns incubating.—CHAPMAN GRANT, *Escondido, California, July 15, 1955.*

Distributional Records of Waterfowl from the Interior of Alaska.—During the past three years several noteworthy observations on the distribution of waterfowl in interior Alaska have come to my attention. The first of these was made by James W. Brooks, who saw two Blue-winged Teal (*Anas discors*) on the Salchaket Slough along the Tanana River near Fairbanks, Alaska, on September 4, 1952. One of the ducks was collected (no. 599 Univ. Alaska Mus.); it proved to be a juvenal female, weighing 445 grams and having minute, uniform-sized ovules. A second observation of the Blue-winged Teal in the interior was made on June 23, 1954, when Robert G. Kirkpatrick, Wilbur L. Libby, and Peter E. K. Shepherd watched a paired male and female in a lightly wooded channel at Minto Lakes, Alaska, thirty miles west of Fairbanks. Although attempts were made to find this pair later in the season, it was not seen again.

The breeding range of the Blue-winged Teal is generally known to extend northwestward to northern Saskatchewan (latitude 58°N), southern Mackenzie (Great Slave Lake), and central British Columbia (Quesnel); Rand (Nat. Mus. Can., Bull. 105, 1946:15) records a pair near the confluence of the Pelly and Ross rivers, Yukon Territory. Scattered occurrences, however, have been noted in Alaska: Kodiak Island (Forest and Stream, 33, 1899:348), Copper River Valley (Abercrombie, Alaska Copper Riv. Expl. Exped. 1899, 1900:137), Fort Yukon and Yukon mouth (Dall and Bannister, Trans. Chicago Acad. Sci., 1869:297), Yukon River (Cantwell, Operations U. S. Revenue Steamer Nunivak, 1899–1901, 1902:286), St. Michael's (Turner, Contrib. Nat. Hist. Alaska, 1886: 133), Atka (*ibid.*), and Cape Romanzoff (Dall and Bannister, *op. cit.*; Nelson, in Arctic Cruise Revenue Steamer Corwin, 1881, 1883:97).

Apparently, no further observations of the Blue-winged Teal in Alaska have been published; recently, however, personnel of the United States Fish and Wildlife Service in Alaska have seen an occasional individual in Alaska. Bob L. Burkholder (*in litt.*) observed an adult with two ducklings on July 13, 1949, on Jim Creek near Palmer in the Matanuska Valley; one was shot at Wrangell in the fall of 1952 (U. C. Nelson, *in litt.*); and Gomer S. Hilsinger reports having seen one in a hunter's bag in Juneau in October, 1953. Victor H. Cahalane reports (*in litt.*) seeing the species on two occasions while he was traveling on the Bartlett River in Glacier Bay National Monument on the afternoon of September 30, 1954.

Another species unusual in interior Alaska is the Ring-necked Duck (*Aythya collaris*). An adult male was collected (no. 801 Univ. Alaska Mus.) at Ace Lake, near College, Alaska, on August 7, 1953, by R. Harkema. The northwestern edge of the range of this species is usually considered to be central British Columbia (latitude 56°N), central Mackenzie Valley (Ft. Simpson), and Athabasca Lake (Ft. Chipewyan), although a female was collected at Marsh Lake, southeast of Whitehorse, Yukon Territory, on October 5, 1920 (Rand, Can. Field Nat., 64, 1950:216) and Soper (Can. Wildl. Serv. Mgmt. Bull., Series 2, No. 7, 1954:31) noted a pair near the outlet of this same lake on June 21, 1950. One other specimen from Alaska was taken on June 11, 1842, at Sitka and is in the Zoological Institute of the Academy of Science of the U.S.S.R. at Leningrad (F. C. Lincoln, in *litt.*). A few sight records also have been recorded from Alaska: Nearer Island, St. Michael's, Amchitka, and Attu (Turner, Contrib. Nat. Hist. Alaska, 1886:133–134); Admiralty Island (Bailey, Auk, 44, 1927:187); Kenai Peninsula (Gabrielson, Auk, 61, 1944:117); Petersburg (Webster, Wilson Bull., 53, 1941:42); and Kodiak (R. D. Jones, *in litt.*).

On May 9, 1954, I observed a European Widgeon (*Mareca penelope*) near Fairbanks, Alaska.

This bird was a highly-plumaged male, apparently unpaired, and was in the company of about ten pairs of Baldpates (*Mareca americana*). Unfortunately, it was not possible to collect the bird, but I watched it for ten minutes This species has been observed in interior Canada—Grand Rapids, Lake Winnipeg, and Fort Rae, Great Slave Lake—but previous reports in Alaska have all been from the coastal areas, chiefly from the Bering Sea (Hasbrouck, Auk, 61, 1944:93–104).

Thanks are extended to I. N. Gabrielson, F. C. Lincoln, and Chandler S. Robbins who kindly assisted in compiling and reviewing waterfowl records for this note, to U. C. Nelson who summarized many of the recent observations made by Alaskan personnel of the United States Fish and Wildlife Service, and to those who made previously unpublished observations available to me.—BRINA KESSEL, *University of Alaska, College, Alaska, May 17, 1955.*

Brown Creeper (*Certhia familiaris*) at entrance to nest in Monterey pine. The nest was 10 feet above ground in a spiral slit. Young left the nest on June 30. Photograph taken on June 24, 1953, at Point Lobos Reserve, Monterey County, California, by Ken Legg.

Acorn Woodpecker on Santa Catalina Island, California.—Since the early period of study of the birds of the channel islands off southern California (see Howell, Pac. Coast Avif. No. 12, 1917), records have accumulated to show that there has been some colonization of these islands by Acorn Woodpeckers (*Balanosphyra formicivora*). This has apparently taken place since the first decade of the century and has resulted in permanent residency in the oaks on Santa Cruz Island (Miller, Condor, 53, 1951:122) and probably on Santa Rosa Island also. Although others may have noted this woodpecker on Santa Catalina, formal record of this further extension of range seems not to have been made. On August 23 and 24, 1955, I noted small groups of this species in the oaks in Avalon and in the oaks of the bottoms of the two canyons northwest of Avalon. Since there were several social or family groups spaced out over a mile of separate canyon systems, the occurrence is hardly to be regarded as casual and seems to reflect a definite colonization.—ALDEN H. MILLER, *Museum of Vertebrate Zoology, Berkeley, California, September 16, 1955.*

NOTES AND NEWS

The attractive and informative color plate of sunbirds accompanying Mr. Williams' article in the September Condor was financed by Maurice A. Machris. Editors and members alike are most appreciative of Mr. Machris' contribution.

We are happy to record with thanks the service performed for the Society this year by Mrs. Sylvia L. Thomssen in the compilation of the Annual Index.

Dates set for the Annual Meeting of the Cooper Ornithological Society in Seattle in 1956 are June 22 to June 24, Friday to Sunday.

We report with regret the death of Stanley G. Jewett of Portland, Oregon, on October 5, 1955. Mr. Jewett was a member of the Cooper Society since 1909 and was elected an honorary member in 1949.

Cost of printing in this issue of The Condor of the major article by Tom Cade on Rough-legged Hawks has been contributed in part by Vernon Barrett. The Society is indebted to Mr. Barrett for this substantial aid.

Several recent books of distinct worth and interest have been received by the editor. Pressure of other work has given no opportunity to prepare formal reviews. Among these are: (1) A. W. Schorger's "The Passenger Pigeon, Its Natural History and Extinction" (University of Wisconsin Press); a scholarly and fascinating account constructed from a wealth of historical sources. (2) George H. Lowery's "Louisiana Birds" (Louisiana State University Press); a very well planned and executed state bird book designed to introduce ornithology to non-technical readers. (3) Devereaux Butcher's "Seeing America's Wildlife in Our National Refuges" (The Devin-Adair Company); an excellently illustrated review of some of the features and values of the national refuge system of the United States.—A.H.M.

COOPER SOCIETY MEETINGS

ANNUAL BUSINESS MEETING

The first session of the annual business meeting of the members of the Cooper Ornithological Society, a corporation, was called to order by President J. R. Pemberton in Scripps Patio, Asilomar, Pacific Grove, California, at 10:30 a.m., Thursday, April 21, 1955. The minutes of the meeting of 1954 were read and approved. The following committees were appointed: Committee to Examine Proxies: Sidney B. Peyton, Henry A. Wylde, and Junea W. Kelly; Committee on Nominations: Junea W. Kelly, Donald D. McLean, and Dorothy E. Groner.

The following proposals for membership were read: Jon B. Ghiselin, 728 Elizabeth Street, Salt Lake City 2, Utah, by William H. Behle; Ruth B. Robertson, 567 Vistamont Avenue, Berkeley 8, Calif., by Junea W. Kelly; Walton A. Smith, 964 Via Verde, Del Rey Oaks, Monterey, Calif., by Mrs. Thomas R. Howell and Wallace G. MacGregor, Jr.; Robert F. Seibert, 17 Canoe Brook Road, Short Hills, N.J., Gerald L. Brody, University Hospital, Ann Arbor, Mich., Walter C. Disler, R.D. 1, La Grange, Ohio, William H. Drury, Jr., Biological Laboratories, 16 Divinity Avenue, Cambridge 38, Mass., Donald B. Martin, Massachusetts General Hospital, Boston 14, Mass., Grace H. Phillips, 1237½ S. Bronson Avenue, Los Angeles 19, Calif., and G. William Richter, P. O. Box 365, Canfield, Ohio, by C. V. Duff.

The meeting was then adjourned until April 22.

The second session of the annual business meeting was called to order by President J. R. Pemberton at the same place at 10:15 a.m., Friday, April 22, 1955. Sidney B. Peyton, reporting for the Committee to Examine Proxies, reported 841 members present or represented by proxy, of a total membership of 1341. A quorum was declared present. Mrs. Junea W. Kelly, reporting for the Committee on Nominations, presented the following names for nomination to the Board of Directors: John Davis, C. V. Duff, Ed N. Harrison, Thomas R. Howell, Alden H. Miller, J. R. Pemberton, Frank A. Pitelka, William J. Sheffler, and Jack C. von Bloeker, Jr. Mr. Pemberton called for further nominations from the floor. There was none. Loye Miller moved that the nominations be closed and that the Secretary cast a unanimous ballot in favor of the election of the entire slate of the nominated directors. The motion was seconded by Sidney B. Peyton and unanimously passed.

The Secretary then read the following proposed amendments to the By-Laws: That Article

I, Section 7, be deleted in its entirety, and that Article I, Section 6, be amended to read as follows: "Section 6. Honorary Members. Honorary Membership may be conferred, by majority vote of the members of the Board of Governors present at any meeting, on members of the Society who have rendered outstanding service to ornithology, particularly in western North America, and/or to the Society. Honorary members shall be exempt from all dues and shall be entitled to all the rights and privileges of active members. The Board of Governors shall annually appoint a committee of three members to search out and select candidates for election to honorary membership and to submit their names to the Board of Governors for the Board's consideration. The Board of Governors shall not be limited, however, in its power to elect honorary members, to candidates submitted by such committee.

That Article III be amended by deleting the first sentence of the second paragraph thereof and by substituting therefor the following: The Board of Governors shall hold meetings at such times and places as it may by resolution determine.

That Article VI be amended by adding a new Section 6, to read as follows: Section 6. Meetings of members shall be held at such places as the Board of Directors shall by resolution determine.

Adoption of these amendments was moved and seconded, and the motion was unanimously passed.

There being no further business, the meeting was then adjourned.

The third session of the annual meeting of the members of the corporation was called to order by President J. R. Pemberton at the same place, at 2:00 p.m., Friday, April 22, 1955. Mr. C. V. Duff, Business Manager, presented a report on the financial condition of the Society. Investment of funds under the supervision of the Investment Committee continues to add significantly to the Society's resources.

There being no further business, the meeting stood adjourned.—JOHN DAVIS, *Secretary*.

SOUTHERN DIVISION

MAY.—The monthly meeting of the Southern Division of the Cooper Ornithological Society was held on May 31, 1955, at the Los Angeles County Museum. The following names were proposed for membership: James T. Bialac, Arizona Ambassador, Phoenix, Ariz., by Mrs. John Q. Burch; Mrs. Richard A. Evans, Klamath Trout Hatchery, Klamath Agency, Ore., and Richard C. Funk, 4731 N. 36th Ave., Omaha 11, Neb., by Jack C. von Bloeker, Jr.; Cecil Carl Kersting, 1365 Lakeshore Dr., Muskegon, Mich., Lester K. Kirk, 19520 Bretton Dr., Detroit 23, Mich., Dr. William B. Robertson, Jr., Illinois Natural History Survey, Urbana, Ill., Emmett L. Shellenberger, Akron Museum of Natural History, 500 Edgewood Ave., Akron 7, Ohio, Robert Taylor Calef, 734 East University, Ann Arbor, Mich.; William Q. Wick, Rt. 3, Mt. Vernon, Wash., and Richard Laurence Zusi, 928 S. Forest, Ann Arbor, Mich., all by C. V. Duff. A. Brâzier Howell was elected to honorary membership by vote of the Division.

Arnold Small reported having seen: On April 30, 1 Parasitic Jaeger and 1 Pomarine Jaeger at Corona del Mar, and a Blue-winged Teal at Newport Bay; 150 evening grosbeaks at Big Bear Lake; on May 14 at Yuma, 1 Least Grebe.

"Outdoor Hazards, Real and Fancied," was the subject of the speaker, Mrs. Mary V. Hood. Her talk was illustrated by Kodachrome slides taken by Mr. A. W. Hood.—DOROTHY E. GRONER, *Secretary*.

SEPTEMBER.—The monthly meeting of the Southern Division of the Cooper Ornithological Society was held on September 27, 1955, at the Los Angeles County Museum. The following names were proposed for membership: Janice Foy Taylor, 408 Panoramic Way, Berkeley 4, Calif., by Marjorie Moody; Mrs. Polly Thomas, 32 Stoddard Way, Berkeley 8, Calif., by Mrs. Junea Kelly; Alfred Wallner, M.D., 729 2nd Ave. E., Kalispell, Montana, by Thomas R. Howell; Prof. Gene H. Linford, Dept. of Zoology, Utah State Agricultural College, Logan, Utah, and Robert Craig Wood, 1007 Los Trancos Rd., Menlo Park, Calif., by Jack C. von Bloeker, Jr.; Loring Gregg Dales, 1555 Club View Dr., Los Angeles 24, Calif., Mrs. Doris Gates, Nebraska State Teachers College, Chadron, Neb., Paul Austin Johnsgard, Dept. Zoology, Washington State College, Pullman, Wash., Emerson Kemsies, Curator of Ornithology, Dept. Zoology, Biology Bldg., Univ. of Cincinnati, Cincinnati, Ohio, Milton Cyril Moore, 902 Highland Rd., Canton, Ohio, James R. Stewart, Jr., 844 Natchez St., Shreveport, La., and Joseph A. Van Loo, Jr., 3804 S.E. 13th Ave., Portland, Ore., by C. V. Duff.

Gerald Collier of the Department of Zoology at the University of California at Los Angeles spoke on the "Behavior of the Bronze-winged Jacana, with notes on other Indian birds."—DOROTHY E. GRONER, *Secretary*.

INDEX TO VOLUME 57

By SYLVIA L. THOMSSEN

A

Accipiter, 70
chionogaster, 37, 46
chionogaster chionogaster, 38
chionogaster ventralis, 38
cooperii, 160, 161
gentilis, 120
gentilis apache, 121
striatus, 38, 83
striatus suttoni, 161
striatus velox, 161
Actitis macularia, 40, 162, *225*, *228*, 367
Adams, Claude T., comparative osteology of the night herons, 55
Aechmophorus occidentalis, 27
Aegithalos caudatus, 83
Aëronautes saxatalis, 37, 66
saxatalis saxatalis, 164, 165
saxatalis sclateri, 165
Aethia cristatella, 292, 298
pusilla, 299
Agamia agami, *227*
Agelaius phoeniceus, *224*, *243*
phoeniceus mearnsi, *233*
phoeniceus phoeniceus, *233*
Aimophila, 193–201
aestivalis, 193, 194, 196, 200
aestivalis bachmani, 199
botterii, 53, 193, 194, 196, 199, 201
botterii botterii, 53
carpalis, 78, 193, 194, 198–201
cassinii, 193, 194, 196, 199, 201
humeralis, 78, 196–201
mystacalis, 194, 197, 201
notosticta, 193, 194, 196, 200, 201
petenica 53, 194, 196, 201
quinquestriata, 193, 194, 201
rufescens, 53, 194, 198, 200, 201
rufescens cinerea, 53
rufescens gigas, 53
rufescens rufescens, 35, 53
rufescens subvespera, 196
ruficauda, 194–201
ruficauda acuminata, 193–198
ruficauda lawrencii, 33, 53, 194, 197
ruficauda ruficauda, 194
ruficeps, 193, 194, 200, 201
ruficeps boucardi, 176
ruficeps eremoeca, 176
ruficeps scottii, 176, 199
ruficeps tenuirostris, 160, 176
strigiceps, 194, 198, 199, 201
sumichrasti, 65, 78, 193–201
Aix sponsa, 120
Ajaia ajaja, 68
Albatross, Black-footed, 292
Laysan, *292*
Alvarez, del Toro (see del Toro)
Amadon, Dean, and Eckelberry, Don R., observations on Mexican birds, 65
Amazilia cyanocephala cyanocephala, 35, 42
violiceps ellioti, 43
violiceps violiceps, *33*, *42*
viridifrons, *42*
Amazona autumnalis, *229*
autumnalis autumnalis, 41
autumnalis salvini, 41
Amblycercus holosericeus, 233
Ammodramus savannarum, 234
savannarum perpallidus, 53
savannarum pratensis, 53
Amphispiza bilineata, 194
bilineata bilineata, *176*
bilineata grisea, 176
bilineata opuntia, *176*
Anabacerthia striaticeps, 230
striaticollis variegaticeps, 34, 45
Anas acuta, *21*, 118, 161
carolinensis, *21*
clypeata, 67
cyanoptera, 22
discors, 22, 37, 68, 161, 377
fulvigula, 227
platyrhynchos, 21, 117, 180, 184
rubripes, 180, 184
streperus, 22
Anhinga, 223
Anhinga anhinga, 227
Ani, Groove-billed, 41
Anser albifrons, 10
albifrons albifrons, 307
albifrons gambelli, 307
Anseranas, 311
Anthreptes orientalis, 261
Anthropoides paradisea, 286–289
Anthus spinoletta, 62, 232
spinoletta japonica, 300
Antpitta, Scaled, 45
Ant-Shrike, Barred, 45
Aphelocoma coerulescens, 159, 168, 231, 350, 370
ultramarina, 159
ultramarina couchii, 160, 167
Aquila, 70
Aracari, Collared, 74
Aramides cajanea, 228
Aramus pictus, 225
scolopaceus, 228
Aratinga canicularis, 41
canicularis canicularis, 33, 36, 41
canicularis eburnirostrum, 41

holochlora, 41, 66
holochlora holochlora, 35, 41
holochlora strenua, 41
Archilochus alexandri, 165
colubris, 43, 225
Ardea, 60
herodias, 37
herodias herodias, 227
herodias wardi, 227
Arenaria, 236
interpres, 228
interpres morinella, 368
Armitage, Kenneth B., territorial behavior in fall migrant rufous hummingbirds, 239
Arremonops conirostris, *234*
rufivirgatus, 78
striaticeps, 234
Asio flammeus, 3, 241, *308*, 362
wilsonianus, 14
Atlapetes, Chestnut-capped, 53
Atlapetes brunnei-nucha, 234
brunnei-nucha brunnei-nucha, 34, 53
gutturalis, 234
Atticora cyanoleuca, 188
cyanoleuca patagonica, 188
Auklet, Crested, *292*, 298
Least, 299
Paroquet, 298
Rhinocerus, 299
Aulacorhynchus prasinus, 43, 229
prasinus chiapensis, 44
prasinus prasinus, 34, 43
Auriparus flaviceps ornatus, 168
Aythya, 21, 223
affinis, 25, 180, 184, *227*
americana, 23
collaris, 23, 372
marila, 120
valisineria, 23

B

Balanosphyra formicivora, 373
formicivora formicivora, 160, 166
Baldpate, 19, 22, 67, 373
Bailey, Robert E., the incubation patch in tinamous, 301
Bartramia longicauda, 367
Basileuterus culicivorus, 51, 233
culicivorus culicivorus, 34, 51
melanogenys, 233
rufifrons rufifrons, 51
Bendell, James F., age, molt, and weight characteristics of blue grouse, 354
Blackbird, Brewer, 89, 121, 174
Red-winged, 243
Yellow-headed, *65*, 173
Blackford, John L., woodpecker concentration in burned forest, 28; nesting of European starling in western Montana, 122; early nesting of golden-crowned kinglet, 242; pygmy nuthatches take arboreal bath, 304; cedar waxwings occupy old nest of western tanager, 309
Bluebird, Eastern, 66, 83
Bob-white, 39, 223, 244, 266–268, 271, 272, 276, 278–281
Bohl, Wayne H., killdeer decoys duck hawk from young, 243
Bolborhynchus lineola, 70
Bombycilla cedrorum, *37*, 171, *232*, 309
Booby, Blue-footed, 123
Brachyramphus marmoratus, 298
Brant, 6, 9
Black, 362, 363
Branta bernicla, 362
nigricans, 6
Brotogeris, 223
jugularis, 229
Bubo virginianus, 11, 229
virginianus pallescens, 164
Bucephala albeola, 25
clangula, 25
islandica, 26
Bufflehead, 19, 24–26
Bunting, Indigo, 53, 62, 225
Orange-breasted, 66
Painted, 53, 174
Varied, 174
Burhinus bistriatus bistriatus, 33, 36, 40
Burns, Robert D., and Howell, Thomas R., mid-winter nesting of the house finch at Los Angeles, California, 246
Busarellus nigricollis nigricollis, 68
Bush-tit, 62
Black-eared, 66, 168
Buss, Irven O., and Dziedzic, Eugene S., relation of cultivation to the disappearance of the Columbian sharp-tailed grouse from southeastern Washington, 185
Buteo albicaudatus hypospodius, 38
jamaicensis, 66, 227, 319
jamaicensis costaricensis, 35, 38
jamaicensis fuertesi, 161
lagopus, 313-346
lagopus kamtschatkensis, 313, 314, 322, 336, 337, 339, 343, 344
lagopus lagopus, 313, 314, 322, 339
lagopus pallidus, 313, 314, 333, 336, 337, 343, 344
lagopus menzbieri, 314, 343
lagopus sanctijohannis, 313–346
lineatus, 227
magnirostris, 37
nitidus, 38
nitidus maximus, 38
nitidus micrus, 38
platypterus, 227
swainsoni, 37
Buteogallus aequinoctialis, 68
anthracinus, 37, 38

anthracinus anthracinus, 68
anthracinus cancrivorus, 68
anthracinus gundlachi, 68
anthracinus micronyx, 68
anthracinus subtilis, 68
gundlachi, 68
urubitinga, 68
Butorides, 60
virescens, 227

C

Cacicus vitellinus, 233
Cacique, Mexican, 51
Cade, Tom J., variation of the common rough-legged hawk in North America, 313
Cairina moschata, 37, 227
Calcarius lapponicus, 15
Calidris canutus, 368
Callipepla squamata castanogastris, 162
squamata pallida, 162
squamata squamata, 162
Calliste, 78
Calocitta formosa, 37
formosa formosa, 76
formosa impudens, 47
formosa pompata, 33, 47
Calonectris leucomelas, 293, 294
Calypte anna, 347–353
Camptostoma imberbe, 47
imberbe ridgwayi, 47
Campylorhynchus brunneicapillus couesi, 169
Campylopterus hemileucurus, 229
Canachites canadensis franklini, 213
Canvasback, 19, 20, 23, 26
Capella gallinago, 228
Caprimulgus vociferus, 37, 66, 121
Caprimulgus vociferus arizonae, 160, 164
Caracara, 65
Caracara cheriway, 37
Cardellina rubrifrons, 160
Cardinal, 174, 226
Carpodacus mexicanus, 89, 246, 351, 370
mexicanus frontalis, 174
mexicanus potosinus, 174
Casmerodius, 60
albus, 37, 227
Cassiculus melanicterus, 33, 36, 51
Cassidix, 236
mexicanus, 51, 121, 224, 233
mexicanus mexicanus, 51
mexicanus monsoni, 121
Catharacta skua, 295
skua maccormickii, 296
Carthartes aura, 37, 66, 227
aura aura, 160, 161
aura teter, 161
Catharus griseiceps, 232
mexicanus cantator, 49
mexicanus mexicanus, 34, 49
occidentalis, 66
Catherpes mexicanus albifrons, 170
mexicanus conspersus, 170
mexicanus mexicanus, 170
Catoptrophorus semipalmatus, 241, 367, 368
Centrocercus urophasianus, 243
Centurus aurifrons, 44
aurifrons frontalis, 44
aurifrons polygrammus, 44
carolinus, 151, 230
hypopolius, 73
rubricapillus, 230
uropygialis, 73
Cercomacra nigricans, 230
Cerorhinca monocerata, 299
Certhia familiaris, 231, 373
familiaris montana, 169
Chachalaca, Plain, 38
Chaetura vauxi, 67
vauxi gaumeri, 42
vauxi richmondi, 42
vauxi tamaulipensis, 37, 42
Chalcomitra, 249
Chamaepetes, 237
unicolor, 228
Chamaethlypis poliocephala, 36
poliocephala palpebralis, 50
Charadrius collaris, 70
hiaticula, 67, 83, 366, 368
hiaticula semipalmatus, 366
nivosus, 239
semipalmatus, 216
vociferus, 228, 243, 372
wilsonia, 67, 228, 368
wilsonia cinnamominus, 367
wilsonia wilsonia, 366
Chat, 223–225, 235
Ground, 50
Yellow-breasted, 50
Chen rossi, 191
Chendytes, 135–137
lawi, 135–143
milleri, 137–143
Chickadee, Black-capped, 226
Carolina, 226
Chlidonias nigra, 228, 240
Chloroceryle aenea, 229
americana, 229
americana hachisuki, 165
americana leucosticta, 165
americana septentrionalis, 43, 165
americana vanrossemi, 35, 43
Chlorophonia, 78
callophrys, 233
Chlorospingus, Brown-capped, 52
Chlorospingus ophthalmicus, 234
ophthalmicus ophthalmicus, 34, 36, 37, 52
ophthalmicus postocularis, 52
pileatus, 234
Chlorura chlorura, 175
Chondestes grammacus, 37
grammacus strigatus, 176

Chondroheirax uncinatus, 37
Chordeiles acutipennis, 66, 129
acutipennis micromeris, 42
acutipennis texensis, 42
minor, 26, 125, 126, 144
minor aserriensis, 125, 126, 144–147
minor chapmani, 125, 126, 144, 146, 147
minor henryi, 144–146
minor hesperis, 144, 145
minor howelli, 147
minor neotropicalis, 144–147
Cinclus cinclus, 83
Cinnyris, 249
habessinicus, 249–261
habessinicus alter, 249–261
habessinicus habessinicus, 249–261
habessinicus hellmayri, 249–261
habessinicus kinneari, 249–261
habessinicus turkanae, 249–261
mariquensis, 254, 256, 257, 258, 260
mariquensis osiris, 257
mariquensis suahelicus, 260
mediocris, 255
osea, 258
venustus, 256
Circus cyaneus, 37, 161, 242
Clangula hyemalis, 189, 304
Claravis pretiosa, 41
Coccyzus americanus, 229
erythrophthalmus, 67, 163
Colaptes auratus, 82, 151, 230
cafer, 29, 66, 123, 151
cafer collaris, 166
cafer nanus, 160, 165
Colibri thalassinus, 42
thalassinus minor, 42
thalassinus thalassinus, 35, 42
Colinus, 237
virginianus, 228, 244, 266
virginianus coyolcos, 39
virginianus insignis, 39
virginianus nelsoni, 39
Columba albilinea, 224, 229
fasciata, 66
fasciata fasciata, 35, 40, 162
flavirostris flavirostris, 33, 40
Columbigallina passerina, 65, 191, 229
passerina pallescens, 41
talpacoti, 65
Colymbus arcticus, 299
stellatus, 299
Contopus, 244, 245
pertinax, 35, 47
pertinax minor, 47
richardsonii placens, 245
richardsonii richardsonii, 47
richardsonii sordidulus, 47
sordidulus peninsulae, 246
sordidulus saturatus, 246
sordidulus sordidulus, 246
sordidulus veljei, 246
virens, 47, 231
Cooch, Graham, spring record of Ross goose from James Bay, Ontario, 191
Coot, 22, 228
European, 83
Coragyps atratus, 37, 70, 227
Cormorant, Double-crested, 224, 226
Olivaceus, 226
Corvus brachyrhynchos, 121
brachyrhynchos brachyrhynchos, 231
brachyrhynchos hargravei, 121
brachyrhynchos hesperis, 121
brachyrhynchos pascuus, 231
corax, 37
corax sinuatus, 168
monedula, 84
Cotinga ridgwayi, 230
Cowbird, 83, 84, 224, 225
Bronzed, 65
Brown-headed, 65
Red-eyed, 51
Crane, Sandhill, 40, 189
Whooping, 286–289, 311
Crane-hawk, Black, 38
Creeper, Brown, 157, 169, 373
Crocethia alba, 368
Crossbill, Red, 53, 66, 120, 121
Crotophaga ani, 229
major, 229
sulcirostris, 47
sulcirostris sulcirostris, 41
Crow, 231
American, 121
Crypturellus cinnamomeus, 37
cinnamomeus soconuscensis, 37
Cuckoo, Black-billed, 67, 163
Lesser Ground, 41
Squirrel, 41
Striped, 70
Cunningham, John D., notes on food habits of the white-tailed kite in southern California, 371
Curassow, 228
Curlew, Hudsonian, 367
Cyanocitta cristata, 76
cristata bromia, 231
cristata cristata, 231
stelleri, 66, 159, 168
stelleri ridgwayi, 66
Cyanocorax yncas luxuosa, 76
Cyclarhis gujanensis, 36, 77, 232
gujanensis flaviventris, 49
Cyclorrhynchus psittacula, 298
Cygnus columbianus, 243
Cypseloides niger, 123
Cyrtonyx montezumae mearnsi, 160, 162
montezumae montezumae, 162
ocellatus, 40
ocellatus ocellatus, 35

D

Dacnis cayana, 232
Dalquest, Walter W., and Lewis, Leo D., whistling swan and snowy owl in Texas, 243
Davis, David E., determinate laying in barn swallows and black-billed magpies, 81; observations on the breeding biology of kingbirds, 208
Dactylortyx thoracius, 39
Delacour, Jean, review of his "The Waterfowl of the World," 311
del Toro, Miguel Alvarez, frigate birds crossing the Isthmus of Tehuantepec, 62; the rufescent mourner in Chiapas, Mexico, 370
del Toro, Miguel Alvarez, and Selander, Robert K., a new race of booming nighthawk from southern Mexico, 144
Dendragapus obscurus, 304, 354–361
  obscurus richardsonii, 213
Dendrocincla homochroa, 37, 230
  homochroa homochroa, 34, 44
Dendrocolaptes certhia sancti-thomae, 44
Dendrocopos, 30, 158
  arizonae, 158, 159
  borealis, 225, 230
  pubescens, 151, 230
  scalaris, 158, 159, 166
  scalaris azelus, 44
  scalaris cactophilus, 160, 166
  scalaris parvus, 44
  scalaris percus, 44
  scalaris symplectus, 166
  villosus, 29, 30, 66, 151, 158, 159, 166, 230
  villosus x Dendrocopos scalaris, 166
  villosus sanctorum, 35, 44
Dendrocygna autumnalis, 67
Dendroica aestiva, 233
  auduboni, 50, 159, 160
  auduboni auduboni, 50, 173
  auduboni memorabilis, 50, 173
  auduboni nigrifrons, 173
  caerulescens, 233
  castanea, 67, 233
  chrysoparia, 37, 50
  coronata, 173, 233
  discolor, 233
  fusca, 233
  graciae, 50, 159, 160
  graciae decora, 50
  graciae graciae, 50
  graciae ornata, 35, 50
  magnolia, 67, 233
  nigrescens, 173
  occidentalis, 371
  palmarum, 233
  pensylvanica, 67, 233
  petechia, 67
  striata, 233
  townsendi, 173
  virens, 67, 233
  virens virens, 50
Dicaeum, 78
Dichromanassa, 60
Dickerman, Robert W., some recent Arizona bird records, 120
Dickerman, Robert W., and Hardy, John William, the taxonomic status of the maroon-fronted parrot, 305
Diomedea immutabilis, 292
  nigripes, 292
Dipper, 83
Dolichonyx oryzivorus, 233
Dove, Blue Ground, 41
  Common Ground, 65
  Ground, 41, 191
  Inca, 41, 65, 191
  Mexican Ground, 191
  Mourning, 65, 163, 224
  Ruddy Ground, 65
  White-fronted, 41
  White-winged, 40, 163
Dowitcher, Short-billed, 223, 368
Dryocopus lineatus, 230
  lineatus scapularis, 44
  lineatus similis, 35
  pileatus, 151, 190
  pileatus abieticola, 230
  pileatus floridanus, 230
Duck, Black, 179, 184
  Black-bellied Tree, 67
  Harlequin, 299
  Old Squaw, 189, 304
  Ring-necked, 19, 23, 24, 372
  Ruddy, 19, 26
  Wood, 120
Dumetella carolinensis, 225, 232
Dysithamnus, 223
  mentalis, 230
Dziedzic, Eugene S., and Buss, Irven O., relation of cultivation to the disappearance of the Columbian sharp-tailed grouse from southeastern Washington, 185

E

Eagle, Bald, 223
Eckelberry, Don R., painting of four Central American tanagers, opposite 3; painting of cinnamon-tailed sparrow, opposite 65
Eckelberry, Don R., and Amadon, Dean, observations on Mexican birds, 65
Edwards, Ernest P., and Lea, Robert B., birds of the Monserrate Area, Chiapas, México, 31
Egret, Common, 128
  Snowy, 128
Elaenia, Yellow-bellied, 75
  flavogaster, 231
  flavogaster subpagana, 75
  forficatus, 68
Elanus leucurus, 190, 371
Empidonax difficilis difficilis, 167
  difficilis hellmayri, 160, 167
  flavescens dwighti, 34, 47

flaviventris, 47, 231
hammondii, 167
minimus, 47, 62, 231
traillii, 231, 245
traillii traillii, 47
wrightii, 167
Eremophila alpestris, 78
Ereunetes mauri, 368
pusillus, 216, 366, 368
Erolia bairdii, 67, 216, 366
fuscicollis, 216, 368
maritima, 216–219
maritima groenlandica, 218, 219
mauri, 241
melanotos, 162, 228, 368
minutilla, 228, 241, 368
Eudocimus albus, 68
Eugenes fulgens aureoviridis, 165
fulgens fulgens, 160, 165
fulgens viridiceps, 35, 43
Euphagus carolinus, 233
cyanocephalus, 89, 121, 174
Euphonia, Blue-hooded, 77
Lesson, 52
Euthlypis lachrymosa, 51
Evenden, Fred G., old-squaw duck at Lake Tahoe, California, 304

F

Falco columbarius, 228
peregrinus, 67, 216, 243
sparverius, 37, 100, 162, 228
Falcon, Laughing, 38
Peregrine, 216, 340
Farner, Donald S., and Mewaldt, L. R., the natural termination of the refractory period in the white-crowned sparrow, 112
Finch, Black Rosy, 61, 306
House, 174, 246, 351, 370
Yellow, 78
Fisher, James, review of his "A History of Birds," 127
Fisher, Harvey I., major arteries near the heart in the whooping crane, 286
Flat-bill, Eye-ringed, 47
Sulphury, 47
Flicker, Red-shafted, 29, 66, 123, 151–153, 165, 166
Yellow-shafted, 82, 151
Florida, 60
caerulea, 59, 60, 227
Flycatcher, Ash-throated, 166
Beardless, 47
Boat-billed, 46
Common Tody, 75
Coues, 47, 157
Derby, 46, 74
Dusky-capped, 74
Fork-tailed, 65
Hammond, 63, 167
Least, 47, 62
Mexican Crested, 47
Nutting, 47
Olivaceous, 157
Olive-sided, 47, 67, 167
Pied, 83
Querulous, 47, 74
Scissor-tailed, 46, 65, 67, 310
Silky, 232
Social, 46, 74
Sulphur-bellied, 46
Traill, 47
Tufted, 66
Vermilion, 46, 65, 167
Vermilion-crowned, 74
Western, 167
Wright, 63, 167
Yellow-bellied, 47
Yellowish, 47
Fratercula corniculata, 299
Fregata magnificens, 62
French, Norman R., foraging behavior and predation by Clark nutcracker, 61
Frigate-bird, 62
Fulica, 288, 289
americana, 22, 225, 228, 286
atra, 83
Fulmar, 291–294, 297
Fulmarus glacialis, 291
glacialis rodgersii, 292

G

Gadwall, 19, 20, 22, 23
Galbula ruficauda melanogenia, 73
Gallinule, 83, 228
Gallinula chloropus, 83, 228
Gavia immer, 227
Gelochelidon nilotica, 228
Gem, Green-throated Mountain, 43
Genelly, Richard E., additional records of emperor goose from California, 63; annual cycle in a population of California quail, 263
Genelly, Richard E., and Rudd, Robert L., avian mortality from DDT in Californian rice fields, 117
Geococcyx californianus, 163
velox affinis, 42
velox melanchima, 41, 42
Geothlypis trichas, 241
trichas brachydactyla, 233
trichas ignota, 233
Geotrygon albifacies anthonyi, 34, 41
Geranospiza nigra, 38
Glaucidium brasilianum ridgwayi, 42
gnoma californicum, 160, 164
gnoma gnoma, 164
gnoma pinicola, 164
Gnatcatcher, Blue-gray, 49, 171
White-lored, 49

Goldeneye, Barrow, 19, 26
Common, 19, 24–26
Goldfinch, American, 89, 210, 370
Lesser, 175
Goose, Australian Magpie, 311
Diving, 135
Emperor, 63, 362, 363
Ross, 191, 312
Tule, 307
White-fronted, 10, 307
Goshawk, 120, 121, 128
Goura cristata, 369
Graber, Richard R., the nighthawks of the Tamaulipas coast of México, 125
Grackle, Boat-tailed, 51, 121, 225
Grallaria guatimalensis guatimalensis, 34, 45
guatimalensis mexicanus, 46
guatimalensis ochraceiventris, 46
Grant, Chapman, killdeer fails to desert displaced nest, 372
Grassquit, Blue-black, 53
Grebe, Least, 67
Pied-billed, 67
Western, 27
Grosbeak, Black-headed, 66, 174
Blue, 53, 174, 213–215
Evening, 128
Rose-breasted, 53, 67
Ground-Cuckoo, Lesser, 66
Grouse, Blue, 304, 354–361
Columbian Sharp-tailed, 185–187
Franklin, 213
Ruffed, 213
Sage, 243
Sharp-tailed, 243
Spruce, 213–215
Grus americana, 286–289
antigone, 286–289
canadensis, 228
canadensis canadensis, 189
canadensis tabida, 189
cinerea, 286
Guan, Crested, 38
Guara alba, 227
Guira guira, 83
Guiraca caerulea, 53
caerulea eurhyncha, 53
caerulea interfusa, 174
Gull, California, 206, 207, 242
Glaucous, 8, 10, 202–207, 297, 362, 363
Glaucous-winged, 202–207, 297, 362, 363
Herring 81, 84, 206, 297
Japanese, 296
Mew, 296
Ring-billed, 242
Slaty-backed, 297
Western, 206
Gymnopithys bicolor, 230
Gymnostinops montezuma, 51

H

Habia rubica, 234
Haematopus, 366
Haliaeetus leucocephalus, 228
Hardy, John William, and Dickerman, Robert W., the taxonomic status of the maroon-fronted parrot, 305
Harpyhaliaetus coronatus, 68
solitarius, 68
Hartman, Frank A., heart weight in birds, 221
Haverschmidt, F., North American shore birds in Surinam, 366
Hawk, Black-collared, 68
Common Black, 38, 68
Common Rough-legged, 313–346
Cooper, 161
Duck, 67, 243, 244
Gray, 38
Marsh, 161
Red-tailed, 38, 66, 161
Rough-legged, 313–346
Sharp-shinned, 38, 83, 161
Sparrow, 100, 162
White-chested, 38
White-tailed, 38
Hawk-eagle, Black and White, 69, 70
Ornate, 70
Hedydipna platura, 256, 258
Heliomaster constantii leocadiae, 33, 43
Heliornis fulica, 228
Henicorhina, 226
leucophrys, 232
leucosticta prostheleuca, 34, 49
Hering, Louise, new nesting records from Boulder County, Colorado, 62
Heron, Black-crowned Night, 55
Great Blue, 223, 224
Green, 225
Louisiana, 223
Yellow-crowned Night, 55
Herpetotheres cachinnans cachinnans, 38
cachinnans chapmani, 38
Heterocnus cabanisi, 227
mexicanus, 37
Himantopus himantopus, 228, 366
Hirundo rustica, 37, 65, 81, 82, 85, 231
Histrionicus histrionicus, 299
Howard, Hildegarde, new records and a new species of Chendytes, an extinct genus of diving geese, 135
Howell, Thomas R., a southern hemisphere migrant in Nicaragua, 188
Howell, Thomas R., and Burns, Robert D., midwinter nesting of the house finch at Los Angeles, California, 246
Hubbs, Carl L., black scoters reported from Baja California, 121
Hudson, George E., an apparent hybrid between the ring-necked pheasant and the blue grouse, 304

Hummingbird, Allen, 348, 350
Anna, 312, 347–353
Azure-crowned, 42
Black-chinned, 165
Blue-throated, 165
Broad-tailed, 164, 165
Calliope, 119, 239, 240
Rivoli, 43, 165
Ruby-throated, 43
Rufous, 239
Swallow-tailed, 43
Violet-crowned, 42
Violet-eared, 42
White-eared, 42, 66
Hydranassa tricolor, 60, 227
Hylocharis leucotis, 66
leucotis leucotis, 35, 42
Hylocichla fuscescens, 232
guttata, 49, 121, 171, 232, 349
guttata auduboni, 171
guttata guttata, 171
guttata slevini, 121
ustulata, 67, 121
ustulata almae, 121
Hypomorphnus urubitinga, 68, 228
Hypopolius, 73

I

Ibis, 227
Glossy, 119, 120
White, 68
White-faced Glossy, 120
Wood, 120
Icterus chrysater chrysater, 52
galbula, 67, 233
gularensis, 52
gularis, 36
gularis gularis, 33, 52
gularis troglodytes, 52
mesomelas, 233
parisorum, 173
pustulatus formosus, 33, 52
spurius, 52
virens, 233
virens virens, 50
wagleri wagleri, 52
Iridoprocne albilinea, 65, 188
bicolor, 84, 231
Irving, Laurence, nocturnal decline in the temperature of birds in cold weather, 262
Ixobrychus exilis, 227

J

Jacamar, Rufous-tailed, 73
Jacana spinosa, 228
Jackdaw, 84
Jaeger, Long-tailed, 6, 296
Parasitic, 5, 9, 10
Pomarine, 3–10, 16, 296
Jay, Blue, 76
Brown, 67, 70, 76
Green, 47, 76
Mexican, 161, 167, 168
Scrub, 350, 352, 370
Steller, 66, 157, 159
White-tipped Brown, 76
Johnsgard, Paul A., courtship activities of the anatidae in eastern Washington, 19
Johnston, David W., the glaucous gull in western North America south of its breeding range, 202
Johnston, Richard F., influence of winter high tides on two populations of salt marsh song sparrows, 308
Jollie, M., new records for Idaho, 189; a hybrid between the spruce grouse and the blue grouse, 213
Junco, Mexican, 177
Oregon, 88–110
Slate-colored, 89, 103, 113
Junco hyemalis, 89, 94, 108, 113
oreganus, 88–110
phaeonotus palliatus, 160, 177
Jynx torquilla, 82

K

Kelly, Junea, W., history of a nesting of an Anna hummingbird, 347
Kessel, Brina, distributional records of waterfowl from the interior of Alaska, 372
Killdeer, 225, 243, 244, 372
Kingbird, Eastern, 67, 208–212
Tropical, 46
Western, 67
Kingfisher, 225
Belted, 165
Green, 43
Little Green, 165
Kinglet, 232
Golden-crowned, 62, 128, 171, 242
Ruby-crowned, 171, 172
Kinsey, Eric Campbell, a recent record of the pileated woodpecker in Marin County, California, 190
Kimsey, J. Bruce, the white-tailed kite in Humboldt County, California, 190
Kiskadee, 74
Kite, Gray-headed, 70
Hooked-billed, 37
Swallow-tailed, 68
White-tailed, 190, 371
Kittiwake, Common, 297
Red-legged, 296, 297
Knot, 368
Kuroda, Nagahisa, observations on pelagic birds of the northwest Pacific, 290

L

Lagopus lagopus, 237
mutus, 236
Lampornis clemenciae bessophilus, 165
clemenciae clemenciae, 160, 165
viridi-pallens viridi-pallens, 43
Laniocera rufescens, 230, 370
Lanius ludovicianus, 100, 225, 232
ludovicianus excubitorides, 171
ludovicianus mexicanus, 171
Lark, Horned 78
Larus argentatus, 81, 206
atricilla, 228
californicus, 206, 242
canus, 84, 296
crassirostris, 296
delawarensis, 242
glaucescens, 202–207, 297, 362
hyperboreus, 8, 202–207, 362
occidentalis occidentalis, 206
schistisagus, 297
Laterallus albigularis, 228
Lea, Robert B., and Edwards, Ernest P., birds of the Monserrate area, Chiapas, Mexico, 31
Leaf-scraper, Tawny-throated, 45
Legg, Ken, photograph of brown creeper, 373
Lepidocolaptes affinis, 230
affinis affinis, 34, 45
Leptodon cayanensis, 70
Leptotila cassini, 229
verreauxi, 229
verreauxi angelica, 41
verreauxi bangsi, 41
Leucophoyx, 60
Leucosticte atrata, 61, 306, 307
australis, 306
tephrocotis tephrocotis, 306
tephrocotis wallowa, 306
Lewis, Leo D., and Dalquest, Walter W., whistling swan and snowy owl in Texas, 243
Limnodromus, 236
griseus, 228, 368
griseus griseus, 368
Limosa, 366
Limpkin, 228
Linnet, 89
Lint, Kenton C., photograph of great crowned pigeon, 369
Lobipes lobatus, 295
Locustella ochotensis ochotensis, 300
Longhurst, William M., additional records of "Tule Geese" from Solano County, California, 307
Longspur, Lapland, 15
Loon, Black-throated, 299
Red-throated, 299
Lophodytes cucullatus, 120, 189
floridanus, 189
Lophortyx californica, 188, 263, 284
gambelii, 244
Lophotriccus pileatus, 231
Lowe, Charles H., Jr., Gambel quail and water supply on Tiburón Island, Sonora, México, 244
Loxia curvirostra, 66, 121
curvirostra mesamericana, 35, 53
curvirostra stricklandi, 53
Lunda cirrhata, 299

M

Macgregor, Wallace, G., cyanide poisoning of song birds by almonds, 370
Magpie, Black-billed, 81, 82, 85, 362, 363
Magpie-jay, 47, 76
Mallard, 19, 21, 27, 84, 117, 118, 179, 184
Manacus vitellinus, 230
Manakin, Thrush-like, 371
Mareca americana 22, 67, 372
penelope, 373
Margarornis rubiginosus, 230
Marshall, Joe T., Jr., hibernation in captive goatsuckers, 129
Martin, Gray-breasted, 188
McMillan, Ian I., an observation of flight exhaustion in California quail, 188
Meadowlark, 225, 243
Eastern, 52, 66, 226
Megaceryle alcyon, 165, 229
Megarynchus pitangua, 46
pitangua mexicanus, 46
Melanerpes erythrocephalus, 74, 151
formicivorus, 230
formicivorus lineatus, 35, 44
hypopolius, 73
portoricensis, 74
uropygialis, 73
Melanitta, 141
fusca deglandi, 138, 141
nigra, 300
perspicillata, 136, 138, 139, 141
Melanotis hypoleucus, 76
melanotis, 76
Meleagris, 237
gallopavo, 228
gallopavo intermedia, 160, 162
gallopavo merriami, 162
gallopavo mexicana, 162
Mellor, Norman H., a winter-active poor-will, 120; Inca dove and ground dove recorded at Corona, Riverside County, California, 191
Melospiza georgiana, 234
lincolnii, 89
lincolnii gracilis, 177
lincolnii lincolnii, 54
melodia, 83, 89, 106, 234, 308
Merganser, Common, 24, 26
Hooded, 120, 189
Mergus merganser, 26

Mewaldt, L. R., and Farner, Donald S., the natural termination of the refractory period in the white-crowned sparrow, 112
Micrastur ruficollis, 228
Micrathene whitneyi, 164
Micropalama himantopus, 366
Miller, Alden H., record of the least flycatcher in central British Columbia, 62; the avifauna of the Sierra del Carmen of Coahuila, México, 154; the breeding range of the black rosy finch, 306; review of Jean Delacour's "The Waterfowl of the World," 311; acorn woodpecker on Santa Catalina Island, California, 373
Miller, F. W., black skimmer in north-central Texas, 240
Mimus gilvus gracilis, 33, 49
polyglottos, 232
polyglottos leucopterus, 170
Miskimen, Mildred, meteorological and social factors in autumnal migration of ducks, 179
Mitrephanes phaeocercus, 66, 231
Mniotilta varia, 50, 172, 232
Mockingbird, 170, 232
Blue, 76
Blue and White, 76
Tropical, 49
Molothrus ater, 65, 83, 233
Montgomery, Vester, hermit warbler at Roswell, New Mexico, 371
Motmot, Blue-crowned, 43
Russet-crowned, 43, 71–73
Momotus mexicanus, 71–73
mexicanus saturatus, 33, 36, 43
momota, 71
momota lessonii, 34, 43
Morococcyx erythropygus, 66
erythropygus erythropygus, 33, 36, 41
erythropygus macrourus, 41
erythropygus mexicanus, 41
Mourner, Rufescent, 370
Rufous, 371
Murre, Common, 298
Thick-billed, 298
Murrelet, Ancient, 298
Japanese, 298
Marbled, 298
Muscicapa hypoleuca, 83
Muscivora forficata, 46, 65, 67, 310
tyrannus, 65
Myadestes obscurus, 66
obscurus oberholseri, 34, 49
townsendi townsendi, 171
unicolor unicolor, 34, 49
Mycteria americana, 37, 120, 227
Myiarchus cinerascens, 47
cinerascens cinerascens, 166
crinitus, 231
ferox, 230
nuttingi, 47
nuttingi flavidior, 47
nuttingi inquietus, 47
tuberculifer, 231
tuberculifer connectens, 47, 74, 75
tuberculifer lawrenceii, 47, 74, 75
tuberculifer littoralis, 75
tyrannulus, 47
tyrannulus magister, 47
tyrannulus nelsoni, 47
Myioborus miniatus, 51, 66, 233
miniatus hellmayri, 51
miniatus intermedius, 34, 51
luteiventris luteiventris, 35, 46
Myiodynastes luteiventris swarthi, 46
Myiozetetes cayenensis, 230
similis, 37, 46
similis texensis, 46, 74
Myrmeciza longipes, 230
Myrmotherula schisticolor, 230

N

Nectarinia, 249
habessinicus, 251
erlangeri, 261
erythroceria, 261
nectarinioides, 261
pulchella, 256, 261
melanogastra, 261
Nighthawk, 125
Booming, 125, 144
Common, 26
Lesser, 42, 66
Trilling, 129
Nightingale-Thrush, Black-headed, 49
Russet, 66
Nomonyx dominicus, 223, 227
Notharchus macrorhynchos, 229
Nothocercus bonapartei, 227
Notiochelidon pileata, 76
Nucifraga columbiana, 61, 76
Numenius phaeopus, 367, 368
Nutcracker, Clark, 61, 76
Nuthatch, Pygmy, 169, 304
White-breasted, 64, 66, 169
Nuttallornis borealis, 37, 47, 67, 167
Nyctanassa, 60
violacea, 55–60, 227
violacea violacea, 55
Nyctea scandiaca, 3, 243, 362
Nyctibius griseus, 229
Nycticorax, 60
nycticorax, 55–60, 227
nycticorax hoactli, 55
Nyctidromus albicollis, 229
albicollis intercedens, 42
albicollis yucatanensis, 42

O

Oceanodroma castro, 295
furcata, 295
furcata furcata, 295
leucorhoa, 122, 295
leucorhoa beali, 122
leucorhoa chapmani, 122
leucorhoa leucorhoa, 295
leucorhoa socorroensis, 122
leucorhoa willetti, 122
tristrami, 295
Oceanites oceanicus, 83
Odontophorus guttatus, 34, 39, 228
guttatus matudae, 39
Oidemia nigra, 121
Oporornis philadelphia, 233
tolmiei, 50
Oreopelia chiriquensis, 229
Oriole, Baltimore, 67
Black-throated, 52
Lesson, 52
Orchard, 52
Scott, 173
Streak-backed, 52
Wagler, 52
Oriturus superciliosus, 200
Ortalis vetula poliocephala, 33, 36, 38
vetula vallicola, 39
Osprey, 70, 161
Otus asio, 321
asio cineraceus, 164
asio suttoni, 160, 163, 164
choliba, 229
flammeolus flammeolus, 163
trichopsis, 163
Owl, 229
Barn, 14, 42, 163
Burrowing, 223
Elf, 164, 247
Flammulated, 163
Ferruginous Pygmy, 42
Great Horned, 235
Hawk, 364
Horned, 11, 161, 164, 166, 168, 364
Long-eared, 14
Pigmy, 164
Screech, 163, 164, 321
Short-eared, 3, 12–16, 241, 308, 362–364
Snowy, 3, 10–12, 16, 243, 362–364
Striped Horned, 224
Oxyura jamaicensis, 26

P

Pachyptila turtur, 364
Pachyramphus polychopterus, 230
Pandion haliaetus, 161
Panyptila cayennensis, 123
cayennensis veraecrucis, 123
sancti-hieronymi, 123–125
Parakeet, Barred, 70
Green, 41, 66
Orange-fronted, 41
Parkes, Kenneth C., and Phillips, Allan R., taxonomic comments on the western wood pewee, 244
Parmelee, David F., and Sutton, George M., the purple sandpiper in southern Baffin Isand, 216
Parrot, 229
Maroon-fronted, 305
Thick-billed, 305
White-crowned, 41
Yellow-cheeked, 41
Parula americana pusilla, 172
pitiayumi, 233
Parus atricapillus atricapillus, 231
atricristatus, 159
atricristatus dyseleptus, 160, 168
bicolor, 225, 231
carolinensis, 231
gambeli, 159
sclateri, 159
wollweberi, 159
Passer domesticus, 82, 83, 113
montanus, 83
Passerculus sandwichensis, 234, 241
Passerella melodia, 241
Passerherbulus henslowii, 234
Passerina ciris pallidior, 53, 174
Passerina cyanea, 37, 53, 62, 234
leclancherii, 66
versicolor versicolor, 174
Pauraque, 42
Pedioecetes phasianellus, 243
phasianellus columbianus, 185–187
Pelecanus erythrorhynchos, 68
occidentalis, 120, 227
occidentalis californicus, 120
Pelican, Brown, 120, 224, 235
White, 68
Penelope purpurascens purpurascens, 38
Penelopina nigra, 37
Penguin, Gentoo, 83
Pepper-shrike, 232
Rufous-browed, 49, 77
Petrel, Australian, 292
Fork-tailed, 295
Leach, 122, 295
Madeira, 295
Peale Gadfly, 294
Solander, 294
Stejneger, 295
Storm, 295
Wilson, 83
Petrochelidon fulva, 75, 76
fulva citata, 75
fulva pallida, 75
pyrrhonota, 231
Peucaea, 194

Peucedramus taeniatus, 37, 159, 160
taeniatus arizonae, 160, 172
Pewee, Western Wood, 244, 245
Wood, 47
Phainopepla, 171
Phainopepla nitens, 171
Phalaenoptilus nuttallii, 120, 129–134
nuttallii nuttallii, 160, 164
Phalacrocorax auritus, 227
macropus, 371
olivaceus, 227
Phalarope, Gray, 295
Northern, 295
Red, 6
Phalaropus fulicarius, 6, 295
Pharomachrus, 34
mocino, 66, 229
mocino mocino, 34, 43
Phasianus colchicus, 117, 304
Pheasant, Ring-necked, 117, 118, 277, 304
Pheucticus ludovicianus, 53, 67, 234
melanocephalus, 66
melanocephalus melanocephalus, 174
tibialis, 234
Philacte canagica, 63, 362
Phillips, Allan R., and Parkes, Kenneth C., taxanomic comments on the western wood pewee, 244
Phloeoceastes guatemalensis, 44, 230
guatemalensis guatemalensis, 44
guatemalensis nelsoni, 44
Phoebe, Black, 167
Say, 167
Phoenicothraupis fuscicauda, 234
phoenicurus phoenicurus, 113
Phylloscopus borealis examinandus, 300
collybita, 84
Piaya cayana, 229
cayana thermophila, 33, 41
Pica pica, 81, 82, 85, 362
Picoïdes, 30
arcticus, 29, 30
tridactylus, 29, 30, 151
Piculus rubiginosus maximus, 35, 44
Pigeon, Band-tailed, 40, 66, 162
Great Crowned, 369
Passenger, 312
Red-billed, 40
Pintail, 19, 21, 117, 118, 161
Pionus senilis, 229
senilis senilis, 41
Pipilo aberti, 363
erythrophthalmus, 66
erythrophthalmus alleni, 234
erythrophthalmus erythrophthalmus, 234
fuscus, 363
fuscus potosinus, 176
fuscus texanus, 160, 175, 176
maculatus, 351
maculatus gaigei, 160, 175
maculatus montanus, 175
Pipit, 232
Water, 62, 300
Pipromorpha oleaginea, 231
Piranga flava dextra, 35, 52, 160, 174
flava oreophasma, 174
leucoptera, 234
leucoptera leucoptera, 34, 52
ludoviciana, 37, 174, 307, 309
olivacea, 67
rubra, 52, 67, 121, 174
rubra cooperi, 121
rubra rubra, 52, 121
Pitangus sulphuratus, 33, 37, 46, 74
sulphuratus derbianus, 47
sulphuratus guatimalensis, 47
sulphuratus texanus, 74
Pitelka, Frank A., review of James Fisher's "A History of Birds," 127
Pitelka, Frank A., Tomich, P. Quentin, and Treichel, George W., breeding behavior of jaegers and owls near Barrow, Alaska, 3
Platyrinchus mystaceus, 231
Plegadis falcinellus, 119, 120
mexicana, 120
Plover, Black-bellied, 366
Collared, 70
Golden, 366
Ringed, 67, 83
Semipalmated, 216, 366
Snowy, 239
Thick-billed, 67
Upland, 366
Wilson, 366
Pluvialis dominica, 366
Podiceps dominicus, 67
Podilymbus podiceps, 37, 67, 227
Poliocephalus dominicus, 227
Polioptila albiloris vanrossemi, 33, 49
caerulea, 225, 232
caerulea amoenissima, 171
caerulea deppei, 49
Polyborus cheriway, 65, 228
Pooecetes gramineus confinis, 176
Poor-will, 120, 129–134, 164
Porphyrula martinica, 228
Porzana carolina, 241
Premnoplex brunnescens, 230
Progne chalybea, 188
subis, 231
Psaltriparus melanotis, 66, 169
melanotis lloydi, 160, 168, 169
minimus, 62, 168, 169
minimus dimorphicus, 169
Pselliophorus tibialis, 234
Pseudocolaptes lawrencei, 230
Psilorhinus mexicanus, 76
morio, 76
Ptarmigan, Alpine, 237
Marsh, 237
Pterodroma inexpectata, 294, 300
solandri, 292, 294, 300

Pteroglossus torquatus, 229
torquatus torquatus, 74
Ptilogonys caudatus, 232
Puffin, Horned, 299
Tufted, 298, 299
Puffinus bulleri, 292, 294, 300
carneipes, 293, 294
griseus, 293
tenuirostris, 291, 293, 294
Pulsatrix perspicillata, 229
Pygochelidon cyanoleuca, 188, 231
Pygoscelis papua, 83
Pyrocephalus rubinus, 46, 65
rubinus blatteus, 46
rubinus flammeus, 46, 167
Pyrrhura, 223
hoffmanni, 229

Q

Quail, California, 188, 263, 266–284, 312
Gambel, 244
Long-toed, 39
Montezuma, 162
Ocellated, 40
Scaled, 162
Spotted, 39
Quail-Dove, White-faced, 41
Querquedula floridana, 189
Quetzal, 43, 66, 226, 236
Quigley, Ray, Jr., snowy plover, a photograph, 239
Quiscalus quiscula 233

R

Rail, Clapper, 241, 242
Virginia, 121, 241, 242
Rallus limicola, 121, 241
obsoletus, 241
Ramphastos sulfuratus sulfuratus, 74
swainsonii, 74, 229
Ramphocelus dimidiatus, 234
icteronotus, 234
passerinii, 234
Raven, Holarctic, 168
Redhead, 19, 23, 26
Redshank, 83
Redstart, 225
Common, 67
European, 113
Painted, 50, 164, 173
Slate-throated, 51, 166
Regulus calendula, 171, 232
calendula calendula, 171
calendula cineraceus, 171
satrapa, 62, 232, 242
satrapa satrapa, 171
Rhinoptynx clamator, 229
Rhodinocichla rosea, 232
Rhynchocyclus brevirostris brevirostris, 47
Rynchops nigra, 240
Rhynchopsitta pachyrhyncha, 305, 306
pachyrhyncha pachyrhyncha, 306
pachyrhyncha terrisi, 306
terrisi, 305, 306
Rhynchospiza stolzmanni, 199
Rhynochetos jubatus, 286
Rhytiptera holerythra, 371
Richmondena cardinalis, 174
cardinalis cardinalis, 225, 234, 236
cardinalis floridana, 225, 234, 236
Riggs, Carl D., night migration of the scissor-tailed flycatcher, 310
Riparia riparia, 65, 231
Rissa brevirostris, 297
tridactyla pollicaris, 297
Road-runner, 163
Lesser, 41
Robin, 243, 351
American, 77, 83, 211, 212
Black, 76
Clay-colored, 49
Rufous-collared, 76
White-throated, 49, 66, 77
Rudd, Robert L., and Genelly, Richard E., avian mortality from DDT in California rice fields, 117

S

Sabine, Winifred S., winter society of the Oregon junco: the flock, 88
Salpinctes obsoletus obsoletus, 170
Saltator, Black-headed, 52
Saltator atriceps, 52, 234
atriceps peeti, 36, 52
maximus, 234
striaticeps, 234
Sanderling, 368
Sandpiper, Baird, 67, 216, 366
Least, 241, 268
Pectoral, 162, 368
Purple, 216–219
Semipalmated, 216, 368
Solitary, 40, 367
Spotted, 40, 162, 367
Stilt, 366
Western, 241, 368
White-rumped, 216, 368
Sapsucker, Yellow-bellied, 121, 166, 225, 226
Sarcoramphus papa, 37, 227
Sayornis, 245
fuscus, 244
nigricans nigricans, 167
nigricans semiatra, 160, 167
phoebe, 230, 244, 246
saya saya, 167
Scardafella inca, 41, 65, 191
Scaup, Greater, 120
Lesser, 25, 179, 184
Schiffornis turdinus, 230, 371
Sclerurus mexicanus mexicanus, 34, 45

Scoter, American, 121
Black, 121, 247, 300
Surf, 122
White-winged, 122
Seiurus, 50, 67
aurocapillus, 233
motacilla, 50
Selander, Robert K., great swallow-tailed swift in Michoacán, México, 123
Selander, Robert K., and del Toro, Miguel Alvarez, a new race of booming nighthawk from southern México, 144
Selasphorus platycercus platycercus, 165
rufus, 239
sasin, 348
scintilla, 229
Serpophaga cinerea, 231
Setophaga picta, 159, 160
picta guatemalae, 35, 50
picta picta, 50, 51, 160, 173
ruticilla, 67, 233
Shearwater, Gray-backed, 294
Pale-footed, 293
Slender-billed, 291, 293, 294, 296
Sooty, 293
Streaked, 293
Shoveller, 23, 67
Shrike, Loggerhead, 100, 171
Sialia sialis, 66, 83, 225, 232
Sibley, Charles G., the responses of salt-marsh birds to extremely high tides, 241; nesting of the western tanager in the Santa Cruz Mountains, California, 307
Sicalis luteola, 78
luteola chrysops, 78
luteola luteola, 78
luteola mexicana, 78
Siskin, Black-headed, 53, 157
Pine, 66, 175
Sitta canadensis, 231
carolinensis, 66, 225, 231
carolinensis mexicana, 169
carolinensis nelsoni, 160, 169
carolinensis oberholseri, 169
carolinensis umbrosa, 169
pygmaea, 304
pygmaea melanotis, 160, 169
Sittasomus griseicapillus, 230
griseicapillus sylvioides, 44
Skimmer, Black, 67, 240
Skua, Arctic, 9
Great, 5, 9, 295
Snakebird, 227
Solitaire, Brown-backed, 49, 66, 157
Slate-colored, 49
Townsend, 171
Sora, 241, 242
Sparrow, Black-chested, 193
Black-chinned, 177
Black-throated, 176, 194
Botteri, 53, 193
Bridled, 197
Cassin, 193
Chipping, 53, 89, 92, 93, 177
Cinnamon-tailed, opp. 65, 78
English, 113
Gambel, 89
Golden-crowned, 112
Grasshopper, 53
House, 82, 83, 85
Lark, 176
Lincoln, 54, 89, 177
Olive, 78
Pine-wood, 193
Rufous-crowned, 176, 193
Rufous-tailed, 193
Rufous-winged, 193
Russet-tailed, 53
Rusty, 53
Savannah, 225, 241
Song, 83, 84, 89, 106, 224, 241, 308
Striped, 157
Sumichrast, 78, 193, 194
Swamp, 224, 225
Tree, 88
Vesper, 176
White-crowned, 112–115, 177, 241
White-throated, 105
Spatula clypeata, 23
Speotyto cunicularia, 229
Sphyrapicus varius, 37, 121, 166, 230
varius nuchalis, 166
varius ruber, 121
varius varius, 166
Spinus notatus notatus, 53
pinus, 66
pinus macropterus, 175
pinus pinus, 175
psaltria, 37
psaltria psaltria, 175
tristis, 89, 370
Spizaetus ornatus, 70
Spizastur melanoleucus, 69, 70
Spizella, 199, 200
arborea, 89
atrogularis, 177
passerina, 89, 225, 234
passerina arizonae, 177
passerina mexicana, 53
pusilla, 234
Spoonbill, Roseate, 68
Sporophila aurita, 234
Squatarola squatarola, 366, 368
Starling, 83, 128, 232, 247
European, 122
Star-throat, Plain-capped, 43
Stelgidopteryx ruficollis, 37, 65, 76, 188, 231
Stellula calliope, 119, 239
Stercorarius longicaudus, 6, 9, 296
parasiticus, 4, 5, 9, 296
pomarinus, 3–10, 296
skua, 5, 9

Sterna dougallii, 228
hirundo, 228
hirundo longipennis, 298
forsteri, 228
Stilt, Black-necked, 366
Storer, Robert W., a preliminary survey of the sparrows of the genus Aimophila, 193
Streptoprocne semicollaris, 66, 71
zonaris, 71
zonaris mexicana, 42
Strix varia, 229
Stultz, Alma, another blue-footed booby in southern California, 123
Sturnella, 236, 243
magna, 66, 224, 233
magna alticola, 52
Sturnus vulgaris, 83, 122, 232
Sula nebouxii, 123
Sunbird, Shining, 249
Sun Grebe, 228
Sutton, George Miksch, glossy ibis in Oklahoma, 119
Sutton, George M., and Parmalee, David F., the purple sandpiper in southern Baffin Island, 216
Swallow, Bank, 65
Barn, 65, 81, 82, 85
Black-capped, 76
Blue and White, 188
Cave, 75
Mangrove, 65, 188
Rough-winged, 65, 76, 188
Tree, 84, 123, 312
Violet-green, 63, 167
Swan, Whistling, 243
Swift, Great Swallow-tailed, 123–125
White-collared, 42, 71
White-naped, 66, 71
White-throated, 66, 164, 165
Vaux, 42, 67
Synallaxis brachyura, 230
Synthliboramphus antiquus, 298
wumisuzume, 292, 298

T

Tachycineta thalassina, 63
thalassina lepida, 167
thalassina thalassina, 167
Tachyphonus rufus, 234
Tanager, Blue, opp. 3
Golden-masked, opp. 3
Hepatic, 52, 174
Scarlet, 67
Scarlet-rumped Black, opp. 3
Silver-throated, opp. 3
Summer, 52, 67, 121, 128, 174
Western, 174, 307, 309
White-winged, 52
Tanagra affinis affinis, 36, 52
elegantissima, 77, 78
luteicapilla, 233
Tangara icterocephala, 233
larvata, 233
Tangavius aeneus, 33, 51, 65
Tapera naevia, 229
naevia excellens, 70
Taraba major, 223, 230
Teal, Cinnamon, 19, 22
Blue-winged, 19, 22, 68, 161, 372
Green-winged, 20–23, 25, 161
Telmatodytes, 226
palustris, 232, 241
Terenotriccus erythrurus, 231
Tern, Black, 240
Common, 67, 223, 224, 235, 298
Roseate, 223, 235
Royal, 67
Sandwich, 67
Thalasseus maximus, 228
sandvicensis, 67
Thamnophilus doliatus, 230
doliatus intermedius, 45
doliatus pacificus, 45
Thick-knee, Mexican, 40
Thrasher, Crissal, 170, 171
Curve-billed, 170
Thraupis episcopus, 234
palmarum, 234
Thrush, Hermit, 121, 171, 349
Swainson, 67, 121
Thryomanes bewickii eremophilus, 160, 170
Thryothorus, 226
leucotis, 232
modestus, 232
pleurostictus, 37, 48
pleurostictus acaciarum, 33, 48
Tiaris olivacea, 234
Tigrisoma lineatum, 227
Tilmatura dupontii dupontii, 35, 43
Tinamou, Rufescent, 37
Tinamus major, 227
Tit, Long-tailed, 83
Titmouse, Black-crested, 168
Bridled, 157
Tityra, Masked, 46, 74
Tityra semifasciata, 74, 230
semifasciata griseiceps, 46
semifasciata personata, 46
Todd, W. E. Clyde, taxonomic comment on races of Leach petrel of the Pacific coast, 122
Todirostrum cinereum, 75
Tolmomyias sulphurescens cinereiceps, 47
Tomich, P. Quentin, Pitelka, Frank A., and Treichel, George W., breeding behavior of jaegers and owls near Barrow, Alaska, 3
Totanus flavipes, 162
totanus, 83
Toucan, Keel-billed, 74
Toucanet, Emerald, 43
Towhee, 225, 226
Brown, 175
Green-tailed, 175

Red-eyed, 66, 224, 226
Spotted, 175, 351
White-eyed, 226
Toxostoma dorsale dorsale, 170, 171
curvirostre celsum, 170
curvirostre oberholseri, 170
rufum, 225, 232
Tree-hunter, Scaly-throated, 45
Treichel, George W., Pitelka, Frank A., and Tomich, P. Quentin, breeding behavior of jaegers and owls near Barrow, Alaska, 3
Tringa flavipes, 228, 367, 368
melanoleuca, 228, 367, 368
solitaria, 367, 368
solitaria cinnamomea, 40
Tripsurus pucherani, 74
Troglodytes, 226
Troglodytes aëdon, 84, 170, 225, 231
aëdon parkmanii, 170
brunneicollis cahooni, 160, 170
brunneicollis compositus, 170
musculus, 231
musculus intermedius, 49
troglodytes, 170
Trogon, Citreoline, 43
Collared, 43
Violaceous, 43
Trogon citreolus sumichrasti, 33, 36, 43
collaris, 226, 229
collaris puella, 34, 43
massena, 226, 229
violaceus, 229
violaceus braccatus, 43
Tucker, Harold M., calliope hummingbird entangled in grass barbs, 119
Turdus affinis, 77
assimilis, 34, 49, 66
assimilis assimilis, 77
assimilis renominatus, 77
filaris, 84
grayi, 35, 77, 232
grayi grayi, 49
infuscatus, 76
migratorius, 77, 83, 211, 232, 243, 351
nigrescens, 76
plebejus, 232
rufitorques, 76, 77
serranus, 76
Turkey, 162, 223
Turnstone, Ruddy, 223, 368
Tyrannula richardsonii, 244, 246
Tyrannus melancholicus, 46
melancholicus chloronotus, 33, 46
melancholicus couchii, 46
melancholicus occidentalis, 46
tyrannus, 67, 208–212
verticalis, 67
vociferans, 37
Tyto alba, 14, 163
alba pratincola, 42

U

Uria aalge, 298
lomvia arra, 298
Uropsila leucogastra, 48
Uropygialis, 73
Urubitornis solitaria, 68

V

Vanellus vanellus, 83
Verdin, 168, 169
Vermivora gutturalis, 233
peregrina, 67, 233
virginiae, 172
Vireo, Black-capped, 171
Gray, 172
Hutton, 172
Red-eyed, 223, 226
Solitary, 50, 157, 172
Warbling, 50, 67
White-eyed, 223
Vireo atricapillus, 171
carmioli, 226, 232
gilvus, 67
gilvus gilvus, 50
griseus, 232
huttoni carolinae, 160, 172
huttoni mexicanus, 172
huttoni stephensi, 172
olivaceus, 232
solitarius, 50, 172, 232
solitarius montanus, 35, 37, 50
solitarius solitarius, 50
Volatinia jacarina splendens, 33, 53
von Bloeker, Jack C., Jr., albino swallow in Sequoia National Park, 63
Vulture, Black, 70, 223
Turkey, 66, 68, 161, 223, 225, 235

W

Warbler, Arctic Willow, 300
Audubon, 50, 157, 173
Bay-breasted, 67
Black and White, 50, 172
Black-throated Green, 50, 67
Black-throated Gray, 173
Canada, 67
Chestnut-sided, 67
Fan-tailed, 51
Golden-cheeked, 50
Golden-crowned, 51
Grace, 50, 157
Hermit, 371
Hooded, 67
Island Grasshopper, 300
Macgillivray, 50
Magnolia, 67
Olive, 172
Parula, 172
Pileolated, 50, 67, 173

Red-faced, 157
Rufous-capped, 51
Tennessee, 67
Townsend, 173
Virginia, 172
Yellow, 67
Waterthrush, 67
Louisiana, 50
Waxwing, Cedar, 171, 223, 309
Wetmore, Alexander, the genus Lophodytes in the Pleistocene of Florida, 189; a supposed record of a fossil cormorant, 371
Whip-poor-will, 66, 121, 164
Wick, William Q., a recent record of the sharp-tailed grouse in Nevada, 243
Widgeon, European, 312, 372
Willet, 241, 368
Williams, John G., a systematic revision and natural history of the shining sunbird of Africa, 249
Wilsonia canadensis, 67, 233
citrina, 67
pusilla, 67, 233
pusilla pileolata, 50, 173
Woodhewer, Barred, 44
Ruddy, 44
Spotted, 44
Spotted-crowned, 45
Woodpecker, Acorn, 44, 164, 166, 373
Arizona, 157
Black-backed, 29
Black-cheeked, 74
Downy, 151–153, 225
Gila, 73
Golden-fronted, 44
Gray-breasted, 73
Guatemalan Ivory-billed, 44
Hairy, 29, 30, 44, 66, 151–153 157, 166
Ivory-billed, 44
Ladder-backed, 44, 166
Lewis, 64
Lineated, 44
Olivaceous, 44
Pileated, 151, 190, 191, 224, 226
Red-bellied, 151, 152, 225
Red-headed, 151, 152
Ruddy-green, 44
Three-toed, 29, 30, 151–153
Wren, Banded, 48
Bewick, 64, 170
Brown-throated, 170
Cactus, 162, 169
Canyon, 170
House, 84
Long-billed Marsh, 241
Rock, 170
Tropical House, 49
White-breasted Wood, 49
Wryneck, 82, 85

X

Xanthocephalus xanthocephalus, 65, 173
Xanthoura yncas vivida, 36, 47, 48
Xiphorhynchus erythropygius, 230
erythropygius erythropygius, 34, 44
flavigaster eburneirostris, 44
flavigaster flavigaster, 44
nanus, 230

Y

Yeager, Lee E., two woodpecker populations in relation to environmental change, 148
Yellow-legs, Greater, 367
Lesser, 162, 367
Yellow-throat, 241

Z

Zarhynchus wagleri, 233
Zenaida asiatica asiatica, 163
asiatica mearnsi, 33, 40, 163
Zenaidura macroura, 37, 65, 229
macroura marginella, 163
Zonotrichia albicollis, 234
capensis, 198, 199, 234
coronata, 112–114
leucophrys, 89, 112–114, 241
leucophrys gambelii, 112–115, 177

For Sale, Exchange, and Want Column—Each member of the Cooper Society is entitled to one short advertising notice in any issue of the Condor free. Notices of over 3 lines will be charged for at the rate of 25 cents per line. Send advertising copy to Jack C. von Bloeker, Jr., Los Angeles City College, 855 N. Vermont Ave., Los Angeles 29, California.

WANTED—The Bleitz Wildlife Foundation is anxious to find someone, working for the doctorate degree, who is interested in conducting research on media for controlling avian botulism. The Foundation will offer a small grant for such work and study. Contact us by mail or call HOllywood 5-6183, Ext. 1.—BLEITZ WILDLIFE FOUNDATION, *1001 N. McCadden Pl., Los Angeles 38, California.*

FOR SALE—The Auk, miscellaneous numbers, 1921–1927 (vols. 38–44), and complete set from 1929 to 1936 (vols. 46–53). Write for details.—DAVID E. DAVIS, *615 N. Wolfe St., Baltimore 5, Md.*

FOR SALE—Collectors' Items: Fuertes, Abyssinian Birds and Mammals, portfolio, 32 colored pls., $32.00; De Serres, Migrations des Animaux, 1845, board, morocco back and corners, $16.00; Jordan, Guide to Fishes, 2 vols., $18.00; Babcock, Turtles of New England, 16 pls. (14 col.), paper cover, $20.00; Ridgway, Nomenclature of Colors, and Compen. Knowledge, 1886, $28.00.—H. H. T. JACKSON, *Room 61, U. S. National Museum, Washington 25, D.C.*

BINOCULAR INFORMATION—Have your binoculars put in shape now for the *Christmas Bird Census*. Mail them to us for a free repair estimate—1 week service on most jobs. Binoculars and 'scopes make wonderful CHRISTMAS GIFTS; also, send for our price-list with quality analysis of Bausch and Lomb and Japanese instruments, all guaranteed free of defects and in alignment to U. S. Government tolerances. Binoculars purchased as gifts now on trial until 2 weeks after Christmas. Reprints of our Binocular articles published in Audubon Magazine still available free to members of Cooper Ornithological Society. We answer questions personally; if you have a binocular problem, let us help you solve it.—THE REICHERTS, *Mirakel Repair Co., 14 W. First St., Mount Vernon 15, N.Y.*

WANTED—Salvin and Godman, Biologia Centrali-Americana, Aves, 4 vols.; and Griscom, Ornithology of Guerrero. Please state price and condition.—F. W. LOETSCHER, JR., *Centre College, Danville, Ky.*

FOR SALE—Auk, 3 single early issues: October, 1889 (vol. 6, no. 4), January, 1899 (vol. 16, no. 1), and October, 1902 (vol. 19, no. 4), each $1.25, including postage; also wish to sell quickly and will accept reasonable offer for any or all of following: Coues' Check List of North American Birds, 2nd ed., 1882; Ridgway's Manual of North American Birds, 4th ed., 1910; A.O.U. Check-List of North American Birds, 3rd ed., 1910; Ridgway's Birds of North and Middle America, parts 1–7 and 9–11 (1–3 bound, others with original paper covers).—FRANK A. PITELKA, *Museum of Vertebrate Zoology, University of California, Berkeley 4, California.*

CONTENTS OF RECENT ISSUES OF THE CONDOR

September-October, 1955

A Systematic Revision and Natural History of the Shining Sunbird of Africa ..... *John G. Williams*

Annual Cycle in a Population of California Quail ..... *Richard E. Genelly*

Major Arteries near the Heart in the Whooping Crane ..... *Harvey I. Fisher*

Observations on Pelagic Birds of the Northwest Pacific ..... *Nagahisa Kuroda*

The Incubation Patch in Tinamous ..... *Robert E. Bailey*

July-August, 1955

A Preliminary Survey of the Sparrows of the Genus *Aimophila* ..... *Robert W. Storer*

The Glaucous Gull in Western North America South of Its Breeding Range ..... *David W. Johnston*

Observations on the Breeding Biology of Kingbirds ..... *David E. Davis*

A Hybrid Between the Spruce Grouse and the Blue Grouse ..... *M. Jollie*

The Purple Sandpiper in Southern Baffin Island ..... *George M. Sutton* and *David F. Parmelee*

Heart Weight in Birds ..... *Frank A. Hartman*

May-June, 1955

Hibernation in Captive Goatsuckers ..... *Joe T. Marshall, Jr.*

New Records and a New Species of *Chendytes*, an Extinct Genus of Diving Geese ..... *Hildegarde Howard*

A New Race of Booming Nighthawk from Southern Mexico ..... *Robert K. Selander* and *Miguel Alvarez del Toro*

Two Woodpecker Populations in Relation to Environmental Change ..... *Lee E. Yeager*

The Avifauna of the Sierra del Carmen of Coahuila, México ..... *Alden H. Miller*

Meteorological and Social Factors in Autumnal Migration of Ducks ..... *Mildred Miskimen*

Relation of Cultivation to the Disappearance of the Columbian Sharp-tailed Grouse from Southeastern Washington ..... *Irven O. Buss* and *Eugene S. Dziedzic*

March-April, 1955

Observations on Mexican Birds ..... *Dean Amadon* and *Don R. Eckelberry*

Determinate Laying in Barn Swallows and Black-billed Magpies ..... *David E. Davis*

Winter Society of the Oregon Junco: The Flock ..... *Winifred S. Sabine*

The Natural Termination of the Refractory Period in the White-crowned Sparrow ..... *Donald S. Farner* and *L. R. Mewaldt*

Avian Mortality from DDT in California Rice Fields ..... *Robert L. Rudd* and *Richard E. Genelly*

C15